IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW
OF
APPLIED MYCOLOGY

VOL. XXIII NOVEMBER 1944

RHOADS (A. S.). **Further notes on Clitocybe root rot of woody plants in Florida.**—*Plant Dis. Reptr*, xxvii, 24, pp. 694–696, 1943. [Mimeographed.]

Further records of root rot due to *Clitocybe tabescens* [*R.A.M.*, xxi, p. 497] in Florida include, among others, *Casuarina cunninghamiana*, planted in or about citrus groves in an effort to secure cold protection, loquat, laurel oak (*Quercus laurifolia*), *Jacaranda ovalifolia*, and Brazilian pepper (*Schinus terebinthifolius*).

CAMPI (M[ARIA] D.). **El marchitamiento de la Acacia de Constantinopla ('Albizzia julibrissin') y su relación con la presencia de 'Fusarium oxysporum' Schl. f. 'perniciosum' (Hepting) Snyder.** [The wilt of the Constantinople Acacia (*Albizzia julibrissin*) and its relation to the presence of *Fusarium oxysporum* Schl. f. *perniciosum* (Hepting) Snyder.]—*Lilloa Rev. Bot. Tucumán*, ix, pp. 457–460, 5 figs., 1943.

Since 1938, a wilt of *Albizzia julibrissin*, characterized by symptoms identical with those described from the United States as due to *Fusarium perniciosum* [*R.A.M.*, xxiii, p. 366], or according to Snyder's system of classification, *F. oxysporum* forma *perniciosum* [ibid., xxi, p. 223], has been present in the Mercedes [Buenos Aires] district of Argentina. Positive results were obtained in inoculation experiments only through the soil, in which infection evidently originates.

LARGE (J. R.). **Alcoholic flux or white slime flux of Tung trees.**—*Plant Dis. Reptr*, xxviii, 1, pp. 35–36, 1944. [Mimeographed.]

The disease of tung trees (*Aleurites*) similar to alcoholic flux or white slime flux of oak (E. F. Guba, *Proc. nat. Shade Tree Conf.*, x, pp. 56–60, 1934), which was known to have occurred in 1938 in the vicinity of Covington, Louisiana, where it was studied and described in 1939 and 1940 by Hines (*Proc. Amer. Tung Oil Ass.*, vi, pp. 12–14, 1940), but was not observed anywhere in the United States during 1941 and 1942, was found in 1943, by E. Angelo, near Folsom, Louisiana. The symptoms of the disease are as follows: a foamy exudate flows from cracks in the bark near the crotch in late summer, usually during early September, accompanied by a characteristic odour of fermentation, attractive to insects; later, an icicle-like mass of gelatinous flux extends down the trunk of the tree from the crotch canker; eventually the trunk is girdled and the tree dies. An as yet unidentified bacterium and an organism considered to be an Actinomycete were isolated by the author from the 1943 canker, and further studies are in progress.

PRIEHÄUSSER (G.). **Über Fichtenwurzelfäule, Kronenform und Standort. Beitrag zur Kenntnis der Fichtenrotfäule.** [On Spruce root rot, crown shape, and habitat. A contribution to the knowledge of Spruce red rot.]—*Forstw. Zbl., 1943*, 6, pp. 259–273, 3 figs., 1943.

Full particulars are given of a comprehensive study on the etiology of a root rot of the spruces in a 60- to 70-year-old stand in the Bavarian Forest near Sträubing.

The primary cause of the trouble was found to be a disturbance of the soil water economy, which does not, however, interfere with the functions of the root system until thinning operations admit direct sunlight, and inadequate protection on the outskirts of the wood gives access to drying winds. The desiccated roots become susceptible to infection by *Trametes radiciperda* [*Fomes annosus*: *R.A.M.*, xvii, p. 86; xxii, p. 120], which lessens the value of the wood and induces anomalies of growth, the neiloid crown with its concave sides, for instance, formed by a diseased tree tending to collapse under pressure of snow. Root-rotted spruces are also liable to be overturned in a storm.

The following possibilities of control are suggested: (*a*) prevention of drying-out of the soil by the maintenance of dense crowns and a compact fringe of shade trees, preferably such as produce an abundance of stool shoots; (*b*) encouragement of the timely development of a deep root system; and (*c*) the replacement of the spruce in localities of the type under observation by fir [*Abies*], pine, larch, or hardwoods.

Huberman (M. A.). **Sunscald of Eastern White Pine, Pinus strobus L.**—*Ecology*, xxiv, 4, pp. 456–471, 3 figs., 1 diag., 3 graphs, 1943.

'Sunscald' is a serious injury to the cambium on the south-west side of eastern white pine (*Pinus strobus*) trunks, the dead strips of bark on which partially peel off and expose the killed sap-wood. The disorder affects dark-coloured, smooth-barked trees, averaging 31 to 51 years of age, on the north and east edges of openings made in forest stands throughout the white pine regions of New England and has also been observed in plantations outside this area. The wounds thus inflicted, besides lowering the grade of logs cut from the scalded part of the trunk, or even rendering them unmarketable, afford ingress to pests and diseases liable to cause further deterioration and endanger the rest of the stand. The scalded strips are 6 to 29 ft. long and 3·3 to 7·7 in. wide (maximum), commencing from 0 to 8 ft. above the ground-line and extending 3·5 to 23 ft. up the trunk. Evidence is adduced to show that the injury occurs between 1st October and 1st April, probably as a result of rapid freezing. It may be avoided by making the smallest possible openings consistent with sound silviculture in harvest and improvement cuttings, leaving 'screen' trees uncut on the southern and western borders of wood lots. Extensive clear-cutting should not be practised, and young trees should be pruned in two or more steps.

Scheffer (T. C.), Lachmund (H. G.), & Hopp (H.). **Relation between hot-water extractives and decay resistance of Black Locust wood.**—*J. agric. Res.*, lxviii, 11, pp. 415–426, 1 fig., 1 graph, 1944.

The results of tests on the durability of black locust (*Robinia pseud-acacia*) [*R.A.M.*, xviii, p. 284], with *Fomes rimosus* as the test fungus, indicate that the amount of hot-water extractives in the wood accounts to a large degree for the decay resistance (expressed in terms of weight loss) of the heartwood at different radial positions in the cross section of individual trees, but only in small measure for the differences in decay resistance among different trees or selections of black locust, suggesting that the toxic composition of the extractive is comparatively uniform within individuals but not among different trees. A similar relation was generally found between decay resistance and the toxicity of the hot-water extractives as measured by the growth rate of *F. rimosus* on malt agar containing the respective hot-water extractives in amounts proportional to those present in the wood. Although theoretically this might be expected to be a better test, the toxicity of the extractives did not index decay resistance as accurately as did total extractive content, probably partly because the error in determining extractive content by measuring the growth rate of the fungus was about three times as great as that in determining it by direct weighing. It is also thought possible that on

substrata as diverse as malt agar and wood, the behaviour of the toxicants may be entirely different. It would thus appear that the test involving measuring extractive content and its toxicity in terms of growth rate of the fungus in artificial culture, at least in the manner adopted in the present study, is inadequate for a precise evaluation of the decay resistance of different trees or selections of black locust. It is believed, however, that a modified procedure might prove more profitable.

It was also found in the course of the study that the amount of yellow colour in the wood, after conversion into sawdust, was roughly proportional to the total extractive content, thus bearing out the widespread belief in the greater durability of yellow heartwood. However, the relation was not consistent enough to serve as a basis of estimation.

BANERJEE (S. N.) & BAKSHI (B. K.). **On the production of true pilei of 'Polyporus brumalis' (Pers.) Fr. in artificial culture.**—*Curr. Sci.*, xiii, 4, pp. 102–103, 3 figs., 1944.

Experimental evidence is adduced to show that aeration is the determining factor in the production of true pilei in artificial culture by *Polyporus brumalis* [*R.A.M.*, xvi, p. 358]. The fungus, collected from a dead log at Calcutta, made abundant growth in closed tubes on Badcock's new medium [ibid., xxi, p. 176], but formed normal pilei only when the stoppers were removed to permit the access of oxygen, which probably neutralized the toxic effect on fructification of the accumulation of carbon dioxide due to vigorous mycelial respiration in the sealed containers. The experiment yielded no conclusive proof of any connexion between light, temperature, or humidity and sporophore formation.

HEPTING (G. H.). **Preventing decay in wood aircraft.**—*Aero Dig.*, xliv, 4, pp. 126, 128, 142, 213, 4 figs., 1944.

Trouble having been experienced through the moulding of glue and consequent fungal decay of aeroplane wood [*R.A.M.*, xxiii, p. 201] in United States Army training machines, the writer gives directions for the recognition of such damage and its prevention by means of appropriate technical devices. Rotting may cause material loss in toughness or shock resistance before there is any noticeable softening or discoloration of the wood. Where casein glue without a preservative has been used the joints, if frequently exposed to water, invariably come apart before appreciable disorganization occurs. When there is no separation of the joints, owing to the use of a more waterproof glue, the best evidence of decay is the presence of free water or mud, extensive water-staining (mahogany generally stains black) [cf. ibid., xxiii, p. 202], or a sour or fermenting odour in the structure.

The woods (except mahogany) commonly used in aircraft construction, e.g., spruce, yellow poplar [*Liriodendron tulipifera*], western hemlock [*Tsuga heterophylla*], noble fir [*Abies nobilis*], sweet gum [*Liquidambar styraciflua*], maple [*Acer* spp.], and ash, are not classed as decay-resistant, and any major swing towards their replacement by more durable species, or to thorough impregnation, would not be practicable at the present juncture. Protection against excess moisture should therefore be based on the provision of proper drainage and precautions to minimize the intake of water from rain, washing, and landing gear splash, and to reduce leakage at the necessary openings.

TYLER (L. J.). **Vegetable storage diseases in New York.**—*Plant Dis. Reptr*, xxviii, 4–5, pp. 143–155, 1944. [Mimeographed.]

This is a summary of observations, partly accompanied by tabulated data, on storage rots [*R.A.M.*, xxi, p. 316] of carrots, celery, cabbage, onions, vegetable

marrows, beets, parsnips, and turnips, made in New York State during the period from December, 1943, to January, 1944.

Reports on disease of vegetable crops.—*Plant Dis. Reptr*, xxvii, 24, pp. 662–681, 1943. [Mimeographed.]

The following items, *inter alia*, occur in these reports. G. M. Watkins states that the most serious disease of vegetables present in Zavala and Dimmit counties, Texas, is caused by aster yellows virus on carrots [*R.A.M.*, xxii, pp. 10, 51]. Examination of numerous commercial plantings in the vicinity of Crystal City, Winter Haven, Carrizo Springs, and Asherton showed that the percentage of carrot plants presenting the symptoms of the disease ranged from 0 per cent. in young fields to about 80 per cent. in fields of nearly mature plants. As a rule, carrots under three months old did not show symptoms. Several fields estimated at about three months old contained from under 1 to about 4 per cent. plants with yellows symptoms. In almost mature fields the percentage of affected plants ranged from 35 to 55 per cent. *Lactuca scariola* was present in and round most fields, and almost always appeared to be affected. *Ximinesia encelioides* was found in or near some fields, and in many cases bore symptoms of the disease. An endive field and an adjoining field of young lettuce showed occasional plants that appeared to be affected [ibid., xx, p. 337]. H. W. Larsh states that in the area concerned (Winter Garden region) infection of carrots averages 30 per cent. The disease was also found, though to a limited extent, in the Lower Rio Grande Valley near Mission and Santa Rosa. The insect vector [*Macrosteles divisus*] was present in every infected field.

E. W. Bodine states that *Uromyces fabae* was found on peas for the first time in Wyoming, on a few plants at Laramie.

H. L. Barnett reports that a small field of rhubarb in the coastal area of central California showed heavy infection by rust (*Puccinia phragmitis*) [ibid., xiv, p. 53], the affected leaves also bearing spots due to *Phyllosticta straminella* [ibid., xvii, p. 732].

Larsh (H. W.). **Aster yellows and other Carrot diseases in the Texas Winter Garden region.**—*Plant Dis. Reptr*, xxviii, 3, pp. 91–92, 1944. [Mimeographed.]

In addition to information already noticed, the author states that the carrot variety Danver Half Long, besides Chantenay and Imperator, was found to be susceptible to aster yellows virus [see preceding abstract].

Leaf blight (*Alternaria carotae*) [*R.A.M.*, xxii, p. 343] was more prevalent in the Winter Garden region of Texas, very few carrot fields being completely free from disease. Considerable yellowing and death of the foliage was observed in La Salle, Uvalde, and Dimmit Counties.

Leaf spot (*Cercospora carotae*) [ibid., xxii, p. 285] was observed in two or three plantings, but caused only negligible losses, even in the most severely affected planting noted, near Carrizo Springs in Dimmit County.

Kleczkowski (A.) & Watson (M[arion] A.). **Serological studies on Sugar-Beet yellows virus.**—*Ann. appl. Biol.*, xxxi, 2, pp. 116–120, 1944.

In studies on the virus of sugar beet yellows [*R.A.M.*, xxii, p. 123] specific antisera were prepared against the sap of a naturally infected plant at Rothamsted by injecting rabbits intraperitoneally at weekly intervals with 5 ml. clarified sap. In the sap the antigen was destroyed by keeping for two to three days at room temperature, or by heating for ten minutes at 52° C. It was unaffected by P_H changes between 5 and 9. In detached leaves at room temperature it remained unchanged for at least six days, but the ability of *Myzus persicae* to transmit it from these leaves fell considerably in four days. Freezing clarified sap and thawing after 24 hours did not affect serological activity or visibly alter the appearance of

the sap. Dialysis of the clarified sap in a cellophane sac against distilled water for three hours at room temperature had no effect on serological activity or appearance, but when the dialysed sap was frozen and thawed it failed to precipitate with antiserum, though its appearance remained unchanged. The addition of 1 per cent. sodium chloride or 2 per cent. sucrose to the dialysed sap before freezing prevented the destruction of the antigen.

Part of the virus in clarified sap was precipitated by 1/4 saturated, and the whole by 1/3 saturated, ammonium sulphate. A bulky, dark precipitate formed, which redissolved almost completely in a volume of water equal to the original volume of sap. The fluid so obtained, after precipitation with 1/3 saturated ammonium sulphate, did not differ in appearance from the original sap and gave the same precipitin titre. Repeated precipitations with ammonium sulphate gave only a slight decrease in the precipitin titre, but gave no useful fractionation, for all the materials precipitating with the virus re-dissolved.

When clarified sap was centrifuged for one hour at 20,000 r.p.m., about half the virus sedimented, while at double this rate all of it sedimented. The sediment was dark green and closely resembled the precipitate produced by ammonium sulphate; it re-dissolved completely in water. All attempts to concentrate the virus failed. Whether or not the antigen is the virus, the precipitin test is specific and can be used for diagnostic purposes. As many different causes produce yellowing of beet leaves, it is helpful to have a rapid test for yellows. The use of crude sap and the specific antiserum provides this, and the test frequently works well on plants from the field. At present, however, while a positive precipitin reaction can be regarded as proof of the presence of the yellows virus, a negative test does not exclude it.

Rosen (H. R.). **Results of vegetable seed treatment in Arkansas, season 1943.**—*Plant Dis. Reptr*, xxviii, 1, pp. 9–10, 1944. [Mimeographed.]

Treatment of Dwarf Telephone pea seed with semesan at the rate of ½ teaspoonful per lb. in Arkansas during 1943 did not significantly increase the yield, but improved the stands by 35 per cent., so that approximately ⅔ lb. of treated seeds per 100 ft. row gave as good a stand as 1 lb. untreated. It is concluded that under war-time conditions of seed scarcity and high prices, seed treatment of peas is desirable on account of the resulting economy in seed. Treatment of bean (Asgrow's Stringless Black Valentine and Landreth's Stringless Greenpod) and of maize (Golden Bantam and Golden Cross Bantam) seed with semesan proved of no or little value.

Johnson (F.) & Jones (L. K.). **A report on a study of virus transmission by fungi and nodule bacteria of Peas.**—*Plant Dis. Reptr*, xxvii, 24, pp. 656–657, 1943. [Mimeographed.]

In experiments carried out to test the possibility that fungi and nodule bacteria (*Rhizobium leguminosarum*) of peas may play a part in virus transmission, *Ascochyta pisi* isolated from pea plants showing severe mosaic and *Cladosporium pisicola* from peas with enation mosaic were cultured separately and inoculated into healthy pea plants. No symptoms of mosaic resulted. Similarly negative results were obtained with conidia of *Erysiphe polygoni* from mosaic peas. Experiments were then made with soil-borne fungi, such as *Rhizoctonia*, *Fusarium*, and *Pythium* spp., causing wilt and damping-off of peas, but no evidence of virus transmission was found. In a test with *Rhizobium leguminosarum* and the white clover mosaic complex, in which surface-sterilized pea seed was immersed in a suspension of the bacteria prepared from nodules from viruliferous plants, sown, and the suspension poured over the seed in the soil, one plant developed mottling, and virus was recovered from it. All the plants then inoculated with virus from this plant developed the same symptoms as the original. No plants became diseased among those where

macerated host tissue without bacteria was added to the soil. The result suggests that more work along this line may be desirable.

Glassock (H. H.), Ware (W. M.), & Pizer (N. H.). **Influence of certain soil factors on chocolate spot of Beans.**—*Ann. Appl. Biol.*, xxxi, 2, pp. 97–99, 1944.

During the summer of 1941, beans growing in south-eastern England were extensively damaged by chocolate spot (*Botrytis cinerea*) [*R.A.M.*, xxi, p. 62]. When dry weather had arrested the outbreak, about 100 fields were examined and the degree of attack classified as slight, moderate, or severe. Investigations were then made to ascertain whether severity of attack could be related to the soil factors of texture, P_H value, available potassium, and available phosphorus.

In the area concerned, the heaviest soils were clay loams (heavy loams), and on these damage was generally slight. The lightest soils were fine, sandy loams (light loams), and on these damage was mostly severe. No more definite indication that soil texture might be related to severity of attack was obtained. For the three grades of attack, slight, moderate, and severe, the mean P_H values of the soils were, respectively, 6·71, 6·76, 6·19. These differences are not considered to be significant. No significant relation was found between degree of attack and available potassium.

The range of values for available phosphorus, however, was 1·1 to 4·5 p.p.m. in the 'slight' grade, 0·75 to 3 p.p.m. in the 'moderate' attack, and 0·75 to 1·5 p.p.m. in the 'severe'. Examination of these figures by the method of analysis of variance, and applying the *F* and *t* tests showed that the grade means differed significantly. The probability that fields in the 'slight' grade differed significantly in available phosphate from the fields in the 'severe' grade was very high (under 0·01), but less high (0·05 to 0·01) between the 'moderate' and 'slight' grades or the 'moderate' and 'severe' grades.

There is thus a definite relation between severity of attack and the availability of phosphorus in the soil, as measured by the method of analysis used. Where available phosphorus was over 2 p.p.m. damage was usually slight, and where it was under 1 p.p.m. damage was generally severe. For arable crops these values are medium to medium high and low, respectively. As 75 per cent. of the thousands of soil samples examined in south-eastern England contained medium or smaller amounts of available phosphorus, phosphates would seem to be generally necessary to reduce chocolate spot in seasons when the disease is active.

Yu (T. F.). **Fusarium diseases of Broad Bean. I. A wilt of Broad Bean caused by Fusarium avenaceum var. fabae n.var.**—*Phytopathology*, xxxiv, 4, pp. 385–393, 1 fig., 1944.

Considerable damage is caused in Yunnan, China, by a wilt disease of broad beans characterized by a greenish-yellow discoloration and withering of the foliage, followed by the death of the plants, the vascular regions of which, especially the tap-root and stem base, turn brown to dark brown. Inoculation experiments with the causal organism, *Fusarium avenaceum* var. *fabae* n.var., gave positive results when seedlings of a height of several inches and upwards were grown in soil contaminated by a spore suspension. Full particulars are given of the morphological and cultural features of the pathogen on a number of nutrient media. From a comparison of the broad bean fungus with Wollenweber and Reinking's descriptions [*R.A.M.*, xiv, p. 708], it is evident that a close relationship with *F. avenaceum* and its vars. *pallens* and *volutum* is involved: varietal rank must, however, be assigned to the first-named on the grounds of its ability to attack the broad bean.

Ark (P. A.) & Gardner (M. W.). **Carrot bacterial blight as it affects the roots.**—*Phytopathology*, xxxiv, 4, pp. 416–420, 2 figs., 1944.

This is an expanded account of the root scab of carrot (*Phytomonas* [*Xantho-*

monas] *carotae*) in California, the salient features of which have already been described [*R.A.M.*, xxii, p. 88].

NUSBAUM (C. J.). **The seasonal spread and development of Cucurbit downy mildew in the Atlantic coastal States.**—*Plant Dis. Reptr*, xxviii, 3, pp. 82–85, 1944. [Mimeographed.]

The author presents the 1943 reports forming part of the reporting service on the cucurbit downy mildew (*Pseudoperonospora cubensis*) situation, conducted co-operatively by various workers from Florida to Massachusetts since 1941. The year under review is stated to have been an average season with regard to downy mildew. The disease occurred throughout the Atlantic region and its destructiveness appeared to be governed by local weather conditions. It was present on cucumbers in Florida at the usual time, but a dry April delayed its development; it appeared at about the normal date on various crops in South Carolina, causing considerable damage; in North Carolina and the Middle Atlantic States it appeared at the usual time but was not generally serious, largely because of unfavourable conditions; and in the New England States it caused heavy losses on late crops.

CHESTER (K. S.). **Destructive diseases in an Oklahoma Spinach-growing area.**—*Plant Dis. Reptr*, xxvii, 25, pp. 708–710, 1943. [Mimeographed.]

An inspection on 30th November, 1943, of about 1,000 acres of spinach near Muskogee, Oklahoma, showed that downy mildew (*Peronospora effusa*) [*R.A.M.*, xxi, p. 63] was present on almost half the acreage, the damage in individual fields ranging from 1 to 50 per cent. In an 80-acre tract, 50 per cent. loss was estimated at $5,000. The land had been planted to spinach in the springs of 1942 and 1943, but no serious losses had then been sustained. No white rust [blister] (*Albugo* [*Cystopus*] *tragopogonis*) [ibid., vii, p. 110] was present. In another tract, however, *C. tragopogonis* caused 40 per cent. loss, but no downy mildew was present. This was the only tract showing white blister. In other tracts, downy mildew was slight to lacking and white blister absent, but spinach blight due to cucumber mosaic virus [cf. ibid., xix, p. 385; xxii, p. 88] was present in all, damage ranging from 10 to 75 per cent. The loss in Muskogee County alone was estimated at $50,000. The fact that every field possessed pathological characters markedly different from those of other fields in the vicinity indicates that the disease problem is localized on each farm and its solution can be worked out individually with each farmer.

Both white blister and downy mildew cause heavy losses in transit. The optimum temperature range for downy mildew infection is 40° to 50° F.; standing water is necessary, and three hours are required for infection to take place. The spinach, when received from the fields, is dumped into vats of cold water and then basketed with powdered ice. Powdered ice is blown into the car, and the spinach is left for three or four days, without re-icing except on long journeys. The cars thus act as moist chambers, and, assuming the ice melts in a day or two, the temperatures are probably within the range of 40° to 50°. Similar conditions apply for white blister.

The Muskogee outbreaks were associated with a month which had virtually no rain; the temperatures, however, were between 40° and 50°, and many heavy dews occurred. Dry weather retarded growth. Most fields had repeatedly been planted to spinach, at least once, and sometimes twice, a year. There is, locally, no spinach in the vegetative state during summer. The crop regularly overwinters in all the fields. Oospores were abundant in all infected leaves with white blister, but were not found in the case of downy mildew.

Control must be worked out on each farm separately according to the pathological characteristics of that farm and the following general principles: (1) where downy mildew is the main problem, land bearing affected crops should be taken out of spinach for at least a year; (2) where blight is the chief trouble, resistant

varieties such as Virginia Savoy or Old Dominion should be planted; (3) where white blister occurs, the resistant, flat-leaved canning varieties Viroflay, Broad Flanders, King of Denmark, Victory, Zwann's Dark Green Bloomsdale, Zwann's Darkie, Prickly Winter, Harlem Market, and Dark Green Giant Prickly should be planted if spinach is to be grown within a year after an infected crop; (4) all seed should be treated.

Middleton (J. T.). **Seed transmission of Squash-mosaic virus.**—*Phytopathology*, xxxiv, 4, pp. 405–410, 2 figs., 1944.

Squash (*Cucurbita pepo* var. *condensa*) mosaic [cucumber mosaic virus] induces a filiform habit of the leaves, which are frequently reduced to the veinous system, with patches of green mesophyll; they may be distorted, rugose, and mottled, with dark green raised areas, but little or no chlorosis occurs. The few misshapen fruits bear dome-like protuberances, $\frac{1}{4}$ to $\frac{1}{2}$ in. in diameter, often yellow or mottled. Growth is retarded, but the diseased plants are seldom killed by the virus, which was shown by experiments with the White Bush Scallop, Yellow Crookneck, and Italian Marrow or Zucchini from San Diego and Orange Countries, California, to be transmitted by the seed [*R.A.M.*, xiv, p. 6]. Low-grade, light, deformed seed was found to carry a higher percentage of the virus than heavy, well-filled specimens from the same population, the figures in the former case ranging from 0 to 37 and in the latter from 0·62 to 2·22 per cent. The infective principle remains viable for three years in the seed, and no difference was observed in the incidence of transmission between seed samples sown shortly after harvesting or three years later.

Some degree of control may be achieved by the use of seed stocks from mosaic-free fields, and possibly also by the location of planting sites at a distance from the breeding-ground of the insect vectors of the disease (aphids and *Diabrotica* spp.) [ibid., xx, p. 189]. In the case of seed taken from infested fields, the percentage of transmission through this channel may be materially reduced by careful winnowing.

Harrison (A. L.) & Kelbert (D. G. A.). **Late blight in Florida.**—*Plant Dis. Reptr*, xxviii, 4–5, p. 116, 1944. [Mimeographed.]

Phytophthora infestans is reported to have caused, for the first time, losses of economic importance to eggplants in a field at Fort Myers, Florida, in 1944, inflicting also considerable damage on potatoes and tomatoes in the same field. The loss in eggplants is estimated by the farmer at 25 per cent. of the entire crop, most of it apparently being due to *P. infestans*, although *Phomopsis vexans* [*R.A.M.*, xxii, p. 511] was also present.

Reports on diseases of vegetable crops.—*Plant Dis. Reptr*, xxvii, 25, pp. 713–723, 1943. [Mimeographed.]

In these notes on diseases of vegetables in different parts of the United States during 1943, it is stated that sweet potatoes near Belle Glade, Florida, were affected by a leaf spot caused by *Cercospora ipomoeae* [*R.A.M.*, xv, p. 344], while a similar leaf spot was very prevalent near Homestead.

Shanor (L.) & Taylor (C. F.). **Diaporthe sojae on Cow-peas.**—*Plant Dis. Reptr*, xxviii, 3, p. 81, 1944. [Mimeographed.]

The occurrence of *Diaporthe sojae* [*D. phaseolorum* var. *sojae*: *R.A.M.*, xxii, p. 463] is reported for the first time on cowpeas near Holland, Virginia. The field in which it was found had been planted to soy-beans in 1942 and was adjacent to a field of soy-beans in 1943. Approximately one-fourth of the stems in the field had light-coloured, round spots characteristic of the pycnidial stage of *D. phaseolorum* var. *sojae* (commonly identified as *Amerosporium oeconomicum*), with numerous black pycnidia scattered in them. Measurements of spores and of pycnidia

agreed with those from infected soy-bean stems. The diagnosis was confirmed by C. L. Lefebvre, who also made single-spore isolations from diseased cowpea tissue and found them to be identical with isolates from soy-beans.

Luthra (J. C.), Sattar (A.), & Bedi (K. S.). **Further studies on the control of Gram blight.**—*Indian Fmg*, iv, 8, pp. 413–416, 1943.

During 1939–40, a supply of about 22,000 maunds [808 tons] of seed of the F_8 line of gram [*Cicer arietinum*], which is highly resistant to blight (*Mycosphaerella rabiei*) [*R.A.M.*, xxi, p. 120] and also gives satisfactory yields under the climatic conditions prevailing in the North Punjab, became available to farmers locally. In 1940–1, this seed was sown over an area of about 40,000 acres. The season was marked by abnormal drought, and a widespread outbreak of wilt [*Fusarium orthoceras* var. *ciceri*: ibid., xxiii, p. 325] occurred in many places. F_8 was severely affected, the evidence demonstrating that this line should be used to replace the local types susceptible to blight only in the districts of Rawalpindi, Jhelum, Gujarat, Attock (excluding Mukbad and Lana) and Shahpar (excluding Khushab tehsil), where, if any soil infection by the wilt organism is present, it is so only in a mild form.

In these localities, F_8 should be sown only when the season has become sufficiently cool, i.e., 10 days to a fortnight after the time generally assumed to be best for sowing the local varieties. As far as possible, the initial amount of moisture in the fields to be planted should be the same as for wheat. As F_8 seed is about 50 per cent. heavier than the local types, the seed rate should be increased correspondingly, in order to secure a normal stand.

In places like Ferozepore and Hissar, where gram is grown extensively, blight is rare. Drought is prevalent in these areas, and most of the damage done to the gram is due to wilt or to unfavourable soil factors. In these districts a wilt-resistant variety is required, whereas in localities such as Lyallpur, Lahore, and Amritsar, where blight and wilt both generally exist, a variety resistant to both diseases is needed.

In selection work carried out to find a variety possessing an equally high resistance to blight without the disadvantages of F_8, small-seeded natural hybrid No. 62–18 gave the best performance.

Kehl (H.). **Zur Sporenkeimung von Psalliota campestris.** [On spore germination in *Psalliota campestris*.]—*Planta*, xxxiii, 5, pp. 731–732, 1943.

For years past running cultures of *Psalliota campestris* have been maintained at the Botanical Institute of Leipzig University in connexion with the writer's studies on spore germination in *Psalliota campestris* [*R.A.M.*, xxii, p. 466]. In consequence, the mushroom spores frequently occur as contaminants in other experimental preparations. Recently, for instance, they found their way into hanging drops of orchid stigma mucus, in which they germinated after two to five days to the extent of 95 per cent. Numerous germination tests were then instituted, drops of *Phalaenopsis* stigma mucus being mixed with equal parts of tap water, inoculated with mushroom spores, and affixed with vaseline to concave slides. Although no special precautions were taken to insure sterility, 40 per cent. of the preparations remained free from contamination by extraneous organisms and in these alone 100 per cent. of the mushroom spores germinated, no germination whatever occurring in the others.

Kligman (A. M.). **Control of the truffle in beds of the cultivated Mushroom.**—*Phytopathology*, xxxiv, 4, pp. 376–384, 1 fig., 1944.

The invasion of cultivated mushroom beds by the truffle or weed fungus, *Pseudobalsamia microspora* [*R.A.M.*, x, p. 290; xx, p. 512], is stated to be responsible for

heavy annual losses in the United States. Experiments having shown that the spores of the intruding organism do not germinate at 60° F. (the optimum is 87°), a positive means of control is afforded through maintenance of the temperature at this level, which permits perfectly normal, though somewhat slow, spawn development. Further evidence is cited, from the experiences of growers known to the author, in support of the view that the soil is the primary source of contamination. Since secondary infection does not occur, the application of fungicides is not warranted, and in any case, a number of preparations tested in six-hour exposures failed to destroy the spores of *P. microspora*. Superficial infection of the beds, which is prevalent, may be combated and mushroom production restored by drying up the infested area, followed after at least three weeks by watering in the usual way.

Chaze (J.). **Essais de production de la Truffe à partir des cultures pures de son mycélium.** [Experiments in Truffle production by means of pure cultures of its mycelium.]—*C.R. Acad. Sci., Paris*, ccxvi, 22, pp. 742–744, 1943.

The writer is carrying out experiments in the production of truffles [*Tuber* spp.: *R.A.M.*, iii, pp. 428, 541; vii, p. 423] by the incorporation into the soil beneath young oaks, at the time of transplanting, of a mixture of mycelium and organic products. The inoculated roots were extensively branched, coralloid, with subterminal swellings, and enveloped by a mycelial 'mantle', and were thus in all respects comparable to those of truffle-producing oaks. It will be some years before the efficacy or otherwise of this mode of cultivation can be established, but in the meantime attention is drawn to the possibility of inducing unduly heavy infection and thereby killing the young trees. Precautions have been planned to obviate this risk in future trials.

Jenkins (Anna E.) & Bitancourt (A. A.). **Histórico de Elsinoë ampelina, o fungo causador da antracnose da Vidéira.** [History of *Elsinoe ampelina*, the fungus responsible for Vine anthracnose.]—*Biológico*, x, 4, pp. 109–114, 1944. [English summary.]

A survey of the history of vine anthracnose (*Elsinoe ampelina*) in South America has disclosed the existence of independent records of the disease dating from 1877, when it was diagnosed by Lefeuvre in southern Chile [*R.A.M.*, xix, p. 366]. The first report of the pathogen from Brazil is that of Goeldi (1888), and in 1910 Puttemans, in a note which was published for the first time in a special number of *Rodriguésia* (1936, issued 1937), described it as the most serious trouble of European vines in that country. Between those years anthracnose was investigated by Campos Novaes and Noack in S. Paulo. Spegazzini observed the disease in Paraguay in 1881 and reported it in 1886, while the records of its occurrence in Argentina, Peru, and Venezuela date from 1896, 1901, and 1934 [*R.A.M.*, xiv, p. 397], respectively.

Reichert (I.), Palti (J.), Minz (G.), & Hochberg (N.). **Trials for the control of Grape Vine diseases. 1. Control of downy mildew (Plasmopara viticola). 2. Control of powdery mildew (Oidium tuckeri).**—*Bull. Rehovoth agric. Res. Sta.* 35, 11 pp., 1944.

In the first of these papers (abbreviated translations from the Hebrew) details are given by Reichert, Palti, and Hochberg of six trials for the control of vine downy mildew (*Plasmopara viticola*) carried out in Palestine. Of the copper sprays tested, Bordeaux mixture (1·5 per cent.) and perenox (0·5 per cent.) gave the best results. Weaker concentrations of these sprays were less satisfactory, and the copper oxychloride preparation cuprogreen (0·5 to 0·75 per cent. spray or 8 per cent. dust) was ineffective. No definite results were obtained as regards the number

of applications required, but treatments at intervals of three weeks were insufficient in seasons when the disease occurred as early as April. The dates on which applications should be made bear no relation to the length of the shoots. All the copper treatments retarded leaf-fall and reduced autumn sprouting, but the extent to which they did so often failed to correspond to their fungicidal efficiency. Copper treatments, it is concluded, exert a direct physiological effect on the vines.

In the second paper (by Reichert, Minz, Palti, and Hochberg) four trials are described against vine powdery mildew (*Oidium tuckeri*) [*Uncinula necator*]. Gaza sulphur (extra fine and superfine) was as effective as yellow sulphur (flowers of sulphur), all these forms of sulphur suppressing the disease almost completely. One application was not enough, but two applications were almost as effective as three. The addition of lime at the rate of 3 kg. to 7 kg. sulphur reduced the cost of the treatment without impairing its effectiveness. The lime-sulphur spray, sulphinette, applied at a concentration of 1 per cent. gave excellent control, and may replace sulphur dusts against *U. necator* whenever spraying appears preferable to dusting. Ammonium polysulphide spray (1 per cent.) was slightly less effective. Spraying with a solution of 0·75 per cent. soda and 0·2 per cent. soft soap is not recommended against this disease in Palestine.

McKinney (H. H.). **Genera of the plant viruses.**—*J. Wash. Acad. Sci.*, xxxiv, 5, pp. 139–154, 1944.

After reviewing the nomenclature and classification of viruses, the author proposes to accord them the rank of a division in the Plant Kingdom, to be designated Viriphyta, and gives an outline of his system of binomial classification, which follows, in the main, The International Rules of Botanical Nomenclature. In this system the ten families of Holmes [*R.A.M.*, xviii, p. 607] are consolidated into two, Marmoraceae and Rugaceae, all viruses inducing mosaic and most of those inducing necrosis in the parenchyma tissues falling into the former, and all those tending to cause malformation but not mosaic-mottling, those inducing yellows type of chlorosis, and nearly all those producing phloem necrosis into the latter. Eight of Holmes's generic names are retained, and several new genera, species, and combinations are proposed. The characters of the various orders, families, and genera are described, and a detailed account given of the type species of each genus. A key to the genera is also supplied.

Neergaard (P.). **7. Aarsberetning fra J. E. Ohlsens Enkes Plantepatologiske Laboratorium. 1 April 1941–31 Marts 1942.** [Seventh annual report from the phytopathological laboratory of J. E. Ohlsen's widow. 1st April, 1941 to 31st March, 1942.]—15 pp., 1942. [Abs. in *Zbl. Bakt.*, Abt. 2, cvi, 8/10, pp. 203–204, 1943.]

During the period under review [cf. *R.A.M.*, xx, p. 516], the 5,165 samples of horticultural seeds examined yielded, *inter alia*, the following new records for Denmark: *Alternaria dianthicola* n.sp. on *Dianthus* sp., *A. resedae* n.sp. on *Reseda odorata*, *A. solani* on *Ageratum houstonianum*, *Ascochyta phaseolorum* on beans, *Heterosporium eschscholtziae* on *Eschscholtzia californica*, and *Phyllosticta orobina* on *Orobus vernus*.

Martyn (E. B.). **Plant Pathological Division.** *Rep. Dep. agric. Jamaica, 1942–43*, p. 16, 1944.

Croucher (H. H.). **Banana Leaf Spot Control Division.** loc. cit., pp. 16–17.

Leach (R.). **Mycological work.**—loc. cit., p. 17.

In this report [cf. *R.A.M.*, xxii, p. 237] it is stated that large banana-growers

in Jamaica continue to fight against Panama disease [*Fusarium oxysporum* var. *cubense*], but small farmers tend to be apathetic and the disease is increasing rapidly. The Agricultural Inspectors endeavour to see that control measures are carried out, at least in areas where infection is not yet widespread. In the absence of gas oil, treatment at present consists in cutting down and chopping up diseased plants *in situ*, treating 'followers' similarly, and leaving the infected site in other respects as undisturbed as possible. The use of lime or fire is in many cases impracticable, and lime is of small value. A banana, described as SA1, possessing potential commercial value and said to be immune from Panama disease and highly resistant to leaf spot (*Mycosphaerella musicola*), was produced by an officer of the Agricultural Department. The Imperial Government's guarantee to purchase a fixed number of stems was extended to June, 1945, the price being fixed at 3s. 3d. per count bunch, less 3d. per count bunch to provide for the purchase of materials to control leaf spot.

It has now been ascertained that while the marked black speckling of banana leaves is due to *Chloridium musae*, a more diffuse type, less clearly visible on the leaf, but equally widespread, is due to *Hormodendrum musicola*. *C. musae* was occasionally found causing spotting on old leaves of plantains surrounded by heavily infected bananas.

Bronze leaf wilt [loc. cit.] continued to cause the death of coco-nuts on the north-west coast, but remained confined to the same area as before. Some Barbados sugar-cane seedlings were affected by pokkah boeng [*Gibberella fujikuroi*]. *Glomerella glycines*, a new record for Jamaica, caused damage to soy-bean pods ripening in wet weather. Sooty black spots on sisal [*Agave rigida* var. *sisalana*] were caused by a species of *Piline*. Pimento rust (*Puccinia psidii*) [ibid., xxi, p. 242] remained static during the year. Other new records for Jamaica included *Cercospora brassicicola* on cabbage, *C. apii* on celery, *C. longissima* on lettuce, *C. malayensis* on okra [*Hibiscus esculentus*], and *Phyllosticta batatas* on sweet potato.

In his report on leaf spot, H. H. Croucher states that incidence was little different from that in previous years. Intensity in the eastern parts of the island declined, and there are still small places on the Blue Mountains and in shaded valleys where satisfactory fruit is produced in the absence of spraying. Perenox, used in place of Bordeaux mixture, gave equally good control, with less wear and tear on equipment. During the year, two depots were closed and three additional sub-depots opened, making a total of 13 depots in operation at the end of March, 1943. Monthly inspections were carried out by the spraying instructor. The twelve different types of spraying equipment in use are serviced by the Leaf Spot Committee in the field and at their workshop.

A large percentage of growers failed to draw their materials regularly, but those who did obtained encouraging results from their spraying. In November, 1942, materials were reduced from 10 lb. each of copper sulphate and lime per acre to 10 lb. copper sulphate and 8 lb. lime. Leaf-spot incidence in unsprayed areas during the year seems to have been lowest in April and May, to have increased in June, and to have reached a peak in November and December, after which it dropped during January, July, and March to a stage between moderate and heavy infection. Growers who sprayed regularly maintained commercial control.

The Leaf Spot Mycologist, R. Leach, states that the individual spots can be subdivided at maturity into the following types: (*a*) broad spots surrounded by a dark ring of gum, (*b*) broad spots with a light ring, (*c*) thin, narrow spots, and (*d*) diffuse spots with no ring. Perithecia tend to be formed in increasing numbers from (*a*) to (*d*). The type of spot largely depends on the age of the leaf when the spot is formed. The most important observation made during the year was that abnormally heavy ascospore infection occurs on certain soils during the season

when ascospore infection is normally at a minimum, i.e., between March and August. In one field, uniformly sprayed with Bordeaux mixture (4–4–40) every three weeks, bananas in sections where the soil was highly acid were very heavily infected in summer, whereas plants under 80 yds. away, on less acid soil, showed excellent control. The spotting on the acid soils was typical of normal winter 'tip-spotting' caused by ascospore infection. It was later observed that the leaf spots of bananas grown on the highly acid soils of Jamaica produce perithecia abundantly throughout the year [ibid., xxii, p. 172]. Apparently, the normal metabolism of the plants becomes altered to such an extent on these soils that the metabolism of the fungus is also affected.

Liming of the highly acid soils did not give encouraging results, indicating that the problem is not merely a simple case of acidity or lime deficiency. This was also shown by the abundant production of out-of-season perithecia occasionally on very alkaline soils of poor fertility. No relation was found between abnormal perithecial production and the amount of phosphorus in the soil or plant.

Spraying schedules in Jamaica aim at reducing conidial infection by consistent spraying in summer, so preventing the subsequent development of perithecia that serious winter infection is avoided. Any soil condition which tends to unbalance the normal metabolism of the banana leaf would also seem to induce an abnormal production of perithecia. The problem demands joint research by the soil chemist, plant physiologist, and plant pathologist.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lv, 6, pp. 235–239, 8 figs., 1944.

In these notes on plant diseases in New South Wales it is stated that war-time methods of handling vegetables in bulk have seriously increased losses due to *Sclerotinia* [*sclerotiorum*: cf. *R.A.M.*, xx, p. 194: xxi, p. 440]. Cool, moist conditions in late winter and spring favour the disease in its early stages, especially on the heavier soils. If subsequent storage, at the cannery or in transport, results in carrots or parsnips being kept for several days or weeks, heavy losses in some batches will be inevitable. The grading of contract-growers, according to their reputation for disease-free produce, will assist in reducing losses. In winter and spring only vegetables from selected farms should be transplanted over long distances or stored for long periods.

Soil disinfection appears to be the only sound method of control on infested land, and even then the benefits may not prove lasting. During wartime any such procedure is beyond the scope of most growers in New South Wales. Growers should, however, use clean land, removing and burning any diseased plants that may appear.

If potato plants have attained considerable growth before being attacked by *Rhizoctonia* [*Corticium solani*], the new growth of the top leaves becomes bunched, giving the plant a rosetted appearance. The leaves may turn purple, and the margins curl up. Aerial tubers may form in the leaf axils. Given favourable weather, the disease may kill the plants even at this stage, but if the soil dries out rapidly they may recover, the leaf symptoms disappearing. The development and progress of the disease depend largely on the weather. In general, early-spring plantings suffer most. Control consists in the use of clean seed, rotation, and disinfection of the tubers [ibid., xx, p. 450].

Recommendations are made for the dusting of pea seed to correct faulty germination. With machine-sown seed, where large areas are to be planted to peas for the first time, and when it is intended to treat the seed with a pea-nodule culture, it is advisable to use spergon at the rate of 1½ oz. per bush. seed. Spergon not only protects the seed from decay, but it is compatible with the pea-nodule culture, and has the additional advantage of lubricating the seed and facilitating

sowing with a multiple drill. Growers using a multiple drill on old ground and not treating the seed with a pea-nodule culture should apply agrosan or ceresan at 1 oz. per bush. In small areas, where hand-sowing is practised, a copper oxychloride dust should be used (bunticide, cuprox, oxycop, saltosan, or smutol) at 2 oz. per bush.

New records for the six months ending on 30th April, 1944, include *Phoma betae* and *Sclerotium rolfsii* on beetroot, *Fusarium* sp. on *Claviceps paspali*, *Bacterium marginatum* on *Freesia refracta*, *Botrytis cinerea* on French beans, *Macrophomina phaseoli* on peas, *Bact.* [*Pseudomonas*] *syringae* on golden poplar (*Populus* sp.), and *Alternaria solani* on eggplant.

Fifty-sixth Annual Report of the Kentucky Agricultural Experiment Station for the year 1943.—64 pp., 1944.

In this report [cf. *R.A.M.*, xxiii, p. 192] it is stated that Ky 41A, a new [black] root rot [*Thielaviopsis basicola*]-resistant Burley tobacco variety was grown extensively in Kentucky in 1943, some 20,000 to 30,000 acres being raised, and several crops of seed were certified. Ky 19, also a new black root rot-resistant Burley, yields very highly on rich land, producing about 10 per cent. more than Ky 16. Ky 52 [loc. cit.] was tested extensively; it remained completely free from tobacco mosaic virus in plantings where the common varieties were heavily infected. The quality appeared to be excellent, and the yields good. Several mosaic-resistant Burley strains (N.N.) were isolated and tested in the field in black root-rot soil. The new strains proved to be as resistant to black root rot as Ky 16, the back-cross parent, and none developed mosaic. Mosaic-resistant varieties will have an additional advantage over susceptible ones in that the stalks can be used on tobacco land without risk of spreading mosaic. Mosaic-resistant (N.N.) strains of dark tobacco apparently identical with Little Orinoco, Woods, and Brown Leaf have been isolated. They remained completely unaffected when inoculated, and should prove of great value in parts of western Kentucky where mosaic causes heavy losses.

Tobacco frog eye (*Cercospora* [*nicotianae*]) [ibid., xx, p. 561; xxii, p. 410] is of major importance in some fields every year, causing frog-eye spots on the lower leaves and green spots on the upper. The spores germinate only when in contact with a moist surface or in a saturated atmosphere. Inoculations of water-soaked tobacco leaves with a water suspension of crushed tobacco roots from the bed and the field gave heavy infection, indicating that the fungus may occur on roots as well as leaves.

Confirmation was obtained of the earlier finding that the angular leaf spot [*Pseudomonas angulata*] and wildfire [*P. tabacum*] organisms live through the summer and winter on the roots of tobacco, legumes, wheat, and other cereals, and on certain weeds [ibid., xxiii, p. 281]. The bacteria were isolated from a field of crimson clover [*Trifolium incarnatum*] and a field of redtop [*Agrostis alba*] and red clover [*T. pratense*] two years after a tobacco crop. Soil samples from 38 pastures and other fields where tobacco beds are commonly made and where tobacco had not been planted for years showed that the angular leaf-spot organism was present in more than half of them and the wildfire organism in a few. It is clear that these diseases may arise in most tobacco beds, so that treatment of the beds with copper sulphate-lime is necessary. Under experimental conditions, wheat served excellently as a host when sterile roots were inoculated, while roots of redtop, timothy [*Phleum pratense*], and, in particular, Kentucky bluegrass [*Poa pratensis*] were more resistant. Infection took place on the rapidly elongating zone of tissue just behind the root cap. No lesions were found on any infected root after five days.

Rapport pour les exercices 1940 and 1941. [Report for the years 1940 and 1941.]—*Publ. Inst. nat. Étud. agron. Congo belge*, 152 pp., 1943.

The following are among the items of phytopathological interest in this report [cf. *R.A.M.*, xix, p. 329]. R. Steyaert's studies on the resistance to stigmatomycosis of different cotton selections (*Nematospora coryli* and *Ashbya* [*N.*] *gossypii*) [ibid., xviii, p. 797] were continued, 3,170 bolls having been inoculated in 1940 and 600 in 1941. Strains 145-116 and 145-84 of selection 145-C-55 appeared to be the most resistant to the disease, but notwithstanding this advantage they yield only second-grade cotton in commercial plantings due to the premature opening of the bolls giving ingress to saprophytes which impair the fibre.

Soil inoculation experiments with rice cultures of *Fusarium vasinfectum* were carried out with a view to the development of wilt-resistant cotton strains. Since the material available for this purpose consisted of old, genetically pure lines of Bambesa, the likelihood of success appeared to be remote, but in 1940 a plant, A 6, believed to be a derivative of 270, exhibited a noteworthy degree of resistance, which descended to its progeny in 1941.

A practical interest attaches to the isolation of the toxin or toxins of *F. vasinfectum*, which may be used in preliminary laboratory work to eliminate seedlings unsuitable for further large-scale trials. The crude extract was found to be useless for the purpose in view and a purified crystalline preparation was finally obtained which proved to be highly toxic to the cotton seedlings.

A species of *Rhizoctonia*, probably *R. bataticola* [*Macrophomina phaseoli*], was observed for the first time on coffee roots. Further studies on the biology of *Glomerella* [*cingulata*: ibid., xxiii, p. 62] on coffee showed that the fungus possesses a Melanconiaceous form with uniseptate, hyaline conidia and hyphal fructifications arising directly from conidiophores barely differentiated from the mycelium. Previous conclusions regarding the limitation of certain strains of *G. cingulata* to particular organs of the host appear to be baseless. Actually the fungus (in the *Colletotrichum coffeanum* stage) may be isolated from the green berries, floral buds, and plumules showing no external symptoms of infection, the incubation period of which presumably extends for several months. Hence inoculation experiments on an organ which may or may not harbour the parasite are without significance. Another point of practical importance arising out of these observations is the questionable value of fungicidal treatments applied after the setting of the berries. Under the conditions prevailing at Mulungu the damage caused by *G. cingulata* is not normally extensive, but on the basis of counts of infected 'cherries' on 2,410 bushes of known descent, Local Bronze was placed in the most resistant category and Mysore in the most susceptible.

Stigmatomycosis, associated with *N. coryli* only, appears to assume a particularly severe form on berries setting unduly late and ripening during the dry season.

Damping-off (*R.* sp.) may be responsible for the total failure of *Cinchona* seedbeds: soil disinfection with mercuric chloride or formalin gave a measure of control. A *Fusarium* of the *Elegans* section and a *Verticillium* have been isolated from plants affected by tracheomycosis, but so far inoculation experiments with these organisms have not yielded conclusive results. Root diseases are caused by *Armillariella* [*Armillaria*] *mellea*, *Rosellinia* sp., *Diplodia theobromae* [*Botryodiplodia theobromae*], and *Helicobasidium* sp.

New plantings of *Pyrethrum* [*Chrysanthemum*] *cinerariaefolium* were damaged by a *Rhizoctonia*, while a serious disease of the inflorescences observed at Tshibinda in 1940 is due in the majority of cases to *Botrytis* sp. The brown spots on the flowers were experimentally reproduced. In the Kivu region of the Belgian Congo, as well as in Kenya, a similar disorder is attributed to the excessive humidity of

the rainy season, so that evidently two distinct factors may operate, independently or in conjunction, to produce the same abnormal effect.

Since the adoption of a rational system of spacing and judicious crop rotation, groundnut rosette is no longer a source of serious trouble in experimental plantings and propagation plots. The crop grown during the second half of the rainy season is more susceptible in each year than the early one. None of the 904 plants inoculated with the virus by colonization with *Aphis laburni* remained immune from rosette.

Sclerospora maydis [ibid., xvii, p. 168] was observed on maize for the first time in the Gandajika region, late sowings sustaining the heaviest damage. *Uromyces appendiculatus* caused severe losses in bean plantings.

Buvat (R.). **Phénomènes de dédifférenciation dans les tumeurs corticales produites chez la Tomate.** [Phenomena of dedifferentiation in the cortical tumours produced in the Tomato.]—*C.R. Acad. Sci., Paris*, ccxvi, 2, pp. 127–129, 1943.

A cytological study of the tumours induced on tomato stems by inoculation with *Phytomonas* [*Bacterium*] *tumefaciens* revealed the total dedifferentiation of the cortical cells into primary meristematic cells, passing through an intermediate stage of the cambial type.

Pal (B. P.). **The Pusa Wheats: the Wheat-breeding work of the Imperial Agricultural Research Institute.**—*Emp. J. exp. Agric.*, xii, 46, pp. 61–73, 1944.

In discussing the wheat breeding investigations carried out at New Delhi [cf. *R.A.M.*, xxii, p. 198], the author reviews the earlier investigations made before the present phase of the work commenced in 1934 and points out that even forty years ago the annual loss sustained in India from the black, brown, and yellow wheat rusts (*Puccinia graminis tritici*, *P. triticina*, and *P. glumarum*) was estimated at Rs40,000,000. As infection is started each year in the plains by spores from the hills, the Imperial Council of Agricultural Research restricted the scope of the present work to the hill regions, and is now considering the breeding of rust-resistant barleys for such stations.

The investigations, carried out in collaboration with K. C. Mehta, were taken up in two stages, the first being the breeding of varieties resistant to one or other of the rusts, and the second the synthesis of varieties resistant to all three. The first stage is nearing completion. Varieties respectively resistant to all the races of yellow and brown rust known to occur in India [ibid., xx, p. 292] have been built up, and others resistant to all the Indian races of black rust will probably soon be developed.

Progress against black rust was slow, because when the work was begun no variety of *Triticum vulgare*, indigenous or imported, was known that was resistant to all the Indian races, but eventually a Kenya wheat, to which the accession number E 144 was given, was found which showed satisfactory resistance. Later, another Kenya wheat (E 220) was found with high resistance. A double cross has been planned, which, it is hoped, will result in the production of varieties with the desired characteristics.

The next most serious disease of wheat in India is loose smut (*Ustilago tritici*) [cf. ibid., xix, p. 583]. Tests to determine the resistance or susceptibility of the wheat strains bred at the Imperial Agricultural Research Institute, and of other wheat varieties likely to be useful in breeding work were begun in 1936 by B. B. Mundkur [ibid., xxi, p. 327]. A few wheats, including Pusa 114, were immune, while others, including Pusa 120 and Pusa 165, were resistant. These three were derived by crossing from Federation, which proved to be immune in the same tests. On the other hand, some of the chief commercial wheats, including Pusa 4, Pusa 12, Pusa 52, the Punjab strains C518 and C519, and the United Provinces strain,

Cawnpore 13, are highly susceptible. Attempts to select resistant sub-strains within some partially susceptible varieties were occasionally successful, showing that varieties apparently homozygous for morphological characters are not necessarily pure for disease resistance. Pusa 120 showed 9·7 per cent. susceptibility in the first year's tests, but the seed 'screened' or 'sieved' by subsequent selection gave immune plants only.

Pusa 4, Pusa 80-5, and Pusa 111 were highly resistant to *Urocystis tritici* [loc. cit.], but in most cases the resistant varieties were susceptible to loose smut. Pusa 165 is resistant to both diseases.

It is hoped shortly to undertake the testing of wheat varieties for resistance to Karnal bunt (*Neovossia indica*) [ibid., xxiii, p. 338].

Stakman (E. C.) & Loegering (W. Q.). **The potential importance of race 8 of Puccinia graminis avenae in the United States.** —*Phytopathology*, xxxiv, 4, pp. 421–425, 1 map, 1944.

During 1943, race 8 of *Puccinia graminis avenae*, with which 10 may be combined for practical purposes [*R.A.M.*, xxiii, p. 173], increased in an alarming manner in the United States, the total number of isolates amounting to 121 as compared with 251 in 1939 and 232 in 1942. The importance of this change in distribution lies in the ability of races 8 and 10 to produce severe infection on Richland oats and various crosses between that variety and Victoria, e.g., Vicland, Boone, and Tama. The two races under observation have been fairly widespread, though not abundant, for some years past, and the possibility of a still further increase in prevalence must therefore be recognized.

Chester (K. S.). **The decisive influence of late winter weather on Wheat leaf rust epiphytotics.** *Plant Dis. Reptr, Suppl.* 143, pp. 133–144, 1943. [Mimeographed.]

It has been shown by an analysis of the relevant meteorological statistics covering 16 epidemic years and 17 of mild infection that the intensity and virulence of wheat leaf [brown] rust [*Puccinia triticina*] are governed almost exclusively by the temperatures and precipitation during the late winter months (December to March in Oklahoma and December to April in Illinois and Iowa), and that the weather in the two following spring months, those in which rust becomes obvious, has very little decisive effect on rust development. The apparently inconsistent weather-rust relationships obtaining in the south-west in 1942–3 and in Illinois from 1922 to 1926 are explicable on this basis. This paradoxical weather-rust relationship is due to the necessity for the rust to increase from its minimum winter prevalence by a logarithmic series of uredo generations, the first of which occurs at a time when the absolute amount of infection is so small as to be almost imperceptible. At this stage, temperatures and rainfall are so near the lower threshold permitting rust multiplication that minor fluctuations in the weather may turn the balance for or against this process. Hereon depends the prevalence of *P. triticina* at the opening of spring, after which time the logarithmic increase of the rust is not appreciably accelerated or retarded by meteorological variations, since the weather conditions during these months are regularly within the range favouring rust development.

Practical considerations arising out of the foregoing analysis include the use of rusted wheat (higher in protein than the normal) as hay; cultivation on wheat land of a summer crop in years when an epidemic is forecast by the close of the late-winter period; attention to the importance of (*a*) late-winter applications of sulphur dust for experimental or commercial rust control, and (*b*) artificial irrigation at the same time of year to induce local epidemics in wheat variety testing nurseries.

Cherewick (W. J.). **An improved method of determining the smut spore load on cereal seed.**—*Canad. J. Res.*, Sect. C, xxii, 3, pp. 120–126, 1 pl., 1 fig., 1944.

The determinations of the smut (*Tilletia* spp.) spore loads present on cereal seed samples by washing and centrifuging having shown that, owing to variability in the surface tension and viscosity of the washings, and, apparently, to some electrical effect, the spore counts were unreliable, the author devised an improved method of making such determinations. Forty gm. seed-grain are placed in a 500 c.c. Erlenmeyer flask and 60 c.c. distilled water containing 0·1 per cent. of a proprietary wetting agent (an ester of sulphonated bicarboxylic acid dispersed in water) are added. The flask is then shaken 30 times, every tenth stroke being made upwards with the flask held upside down. Next, 10 c.c. of the washings are at once poured into a centrifuge tube, and centrifuged for four minutes at 2,400 r.p.m., the supernatant liquid then being siphoned off to within 0·3 c.c. To the residue 0·2 c.c. of a 4 per cent. gelatine solution maintained at 45° C. is added, to make a total of 0·5 c.c. The spores are then dispersed in this medium by stirring. If the sample is dirty, distilled water and gelatine are added in the proportions mentioned above to double or treble the amount of the dispersion medium. A loopful of the residue is withdrawn, placed on a special slide (similar to a haemocytometer, with a 5 m.m. counting square and a film 130μ thick), and covered with a cover glass. If the spores are numerous, eight microscopic fields are counted; if few, eight swaths across the square are counted. The spore load is determined by comparing the counts with those of standards made for each kind of grain by counts on artificially smutted samples carrying a range of known spore loads.

Dillon Weston (W. A. R.). **Bunt of Wheat.**—*J. Minist. Agric.*, li, 6, pp. 264–265, 1 fig., 1944.

This is a brief, popular account of wheat bunt (*Tilletia caries*) and its control by seed treatment with organo-mercury dressings. The life-history of the fungus is depicted in a chart.

Brandwein (P. F.). **Seedling invasion of the covered smut of Oats.**—*Phytopathology*, xxxiv, 5, pp. 481–484, 1 fig., 1944.

Continuing his studies on the invasion of oats seedlings by covered smut (race 7 of *Ustilago kolleri*) [*R.A.M.*, xx, p. 108], the writer inoculated dehulled seeds and 24-hour-old seedlings of the Monarch and Markton varieties with dry chlamydospores and allowed them to germinate at 20° C. in sand with a moisture content of 20 per cent. of its water-holding capacity; the plants of the former series were removed for examination after 48 hours and those of the latter after 72. Only about 10 per cent. of the spores germinated on the seedling inoculated at 24 hours. The total number of invasions in the 143 seedlings under investigation was 922, of which 390 were effected directly from the chlamydospores and 532 through hyphal fusion or by uncertain means; the latter group comprised only 52 cases involving apparent sporidial fusion, though this process was completely observed in the mat of smut spores sometimes found in the sand beside the seeds.

Various points in connexion with the experimental data require further elucidation, but in the meantime it may be noted that promycelial penetration directly from chlamydospores of *U. kolleri* is more extensive than has hitherto been supposed.

Twyman (E. S.). **Manganese-deficient soils.**—*Nature, Lond.*, cliv, 3906, p. 336, 1944.

Using a slightly modified form of Sherman, McHargue, and Hodgkiss's method (based on Leeper's [*R.A.M.*, xv, p. 8]) of identifying (*a*) manganese-deficient neutral and alkaline soils, (*b*) strongly acid soils that will become manganese-

deficient when limed to near neutrality, and (*c*) soils likely to contain such excess of available manganese as to be toxic to plants (*Soil Sci.*, liv, p. 253, 1942), the authors investigated three types of soil: (1) a light, black, heath soil from Shropshire with a strongly acid reaction, (2) a heavy Lias clay from south Warwickshire with an almost neutral reaction, and (3) a garden loam from Birmingham with P_H over 7. Manganese-deficient oats were growing on the first two and healthy oats on the third. The Shropshire soil samples had P_H values between 6·4 and 7·9, due to the heavy liming, and were definitely manganese-deficient. The Lias soil had P_H values between 6·3 and 7. The high P_H value of the Birmingham soil was due to heavy liming.

The Shropshire soil samples showed 2·8 to 8·2 p.p.m. of easily reducible manganese, the Warwickshire samples 25·6 to 43·7 p.p.m., and the Birmingham soils 98·2 to 183 p.p.m. These figures show that the easily reducible manganese is the important fraction in identifying manganese-deficient soils. This supports the conclusion of Sherman and his co-workers that manganese-deficient soils are identifiable by this method.

Klotz (L. J.). **A simplified method of growing plants with roots in nutrient vapours.** —*Phytopathology*, xxxiv, 5, pp. 507–508, 1 fig., 1944.

The apparatus assembled to facilitate the study of *Phytophthora* infections and of the toxicity of various concentrations of nitrite and other ions on citrus [*P. parasitica* and *P. citrophthora*] and avocado [*P. cinnamomi*] roots [*R.A.M.*, xxiii, p. 106] consists of a 12 l. cylindrical glass jar containing 3 l. or less of nutrients, which is re-circulated in vapour form over the roots of the plants suspended through holes in the cover with a De Vilbiss atomizer, operated by air pressure. A glass tube attached to the intake of the atomizer extends to the bottom of the jar, and clogging of the atomizer by sloughed root material is obviated by filtering the nutrient entering the intake through Pyrex glass wool. Only a small amount of solution escapes as vapour through the holes of the plant support. The equipment is also adaptable to use with the continuous-flow method of supplying nutrient (*J. agric. Res.*, liii, pp. 433–444, 1936; lvi, pp. 73–80, 1938).

Fraser (Lilian). **Phytophthora root rot of Citrus.** *Agric. Gaz. N.S.W.*, lv, 5, pp. 197–200, 7 figs., 1944.

The information presented in this account of the root rot of citrus caused by *Phytophthora citrophthora* has already been given elsewhere [*R.A.M.*, xxii, p. 133; xxiii, p. 175].

Govande (G. K.). **Breeding for resistance to Cotton root rot in Gujarat.** Abs. in *Proc. Indian Sci. Congr.*, xxix, Sect. xi, p. 217, 1942. [Received May, 1944.]

Investigations are in progress in Gujarat on the breeding of a cotton strain resistant to root rot (*Macrophomina phaseoli*) to replace the susceptible Broach 9 (*Gossypium herbaceum* var. *frutescens*) [*R.A.M.*, xvii, p. 34 *et passim*]. Preliminary trials established the partial resistance of a bulk of survivors collected from infested fields in the village of Kharkhadi near Baroda. Continuous selection on this material has resulted in the development of families with a mortality of only 20 to 30 per cent. compared with 95 per cent. in Broach 9. The spinning value of these lines, however, is very low, so that cultivators are unlikely to find them profitable. Among the factors complicating the work of breeding for resistance to root rot in *G. herbaceum* var. *frutescens* are the extreme heterogeneity of the disease in the soil, simultaneous selection for other characters, the dominance of resistant genes, and a considerable heterozygosity in this respect of the local material. The next steps are to be directed towards a combination of the resistance

of the Kharkhardi selections and of Rozi (*G. arboreum* var. *typicum*) with the quality of *herbaceum* strains by hybridization.

Deschiens (R.), Lamy (L.), & Vautrin (E.). **Essais pratiques de prophylaxie de l'anguillulose des végétaux par l'emploi d'Hyphomycètes prédateurs.** [Practical trials in the prophylaxis of plant nematodes by predaceous Hyphomycetes.]—*C.R. Acad. Sci., Paris*, ccxvi, 15, pp. 539–541, 1943.

In order to test the practical utility of certain predaceous Hyphomycetes in the control of the larvae of *Heterodera marioni*, a ubiquitous nematode attacking the roots of over 600 species of plants, two lots of Gloire de Lorraine *Begonia* were planted in pots, namely, 21 protected by the incorporation with the compost of 1 per cent. cereal chaff cultures of *Dactylella bembicodes* and *Arthrobotrys oligospora* [*R.A.M.*, xxii, p. 306] and 18 left untreated. The incidence of eelworm infestation in the protected and control series amounted to 3 out of 21 (14 per cent.) and 8 out of 18 (44·4 per cent.), respectively, while the numbers of tumours per plant were 5 and 85, respectively. Of the 11 plants supplied with cultures of *D. bembicodes*, the one infested bore a single tumour on the root-collar, while in the *A. oligospora* series, each of the two infested plants bore five excrescences on the extremities of the roots.

Adam (D. B.) & Piper (C. S.). **The use of zinc for Flax.**—*J. Dep. Agric. S. Aust.*, xlvii, 10, pp. 422–426, 2 figs., 1944.

Flax growing in several parts of South Australia has been affected since 1941 with a die-back apparently due to zinc deficiency [cf. *R.A.M.*, xxi, p. 483]. Early in spring, patches of plants remain stunted, though later on the affected plants catch up fairly well with the healthy ones. The stalks of the diseased plants are spindly and less freely matured than those of normal ones, and are, actually, second shoots which have developed from the base of the plant, the first shoot having died at the tip. The stunting results from the early death of the leading shoot. Side shoots develop at the base, but in the spring are still very short. In severe cases, the tips of the secondary shoots may also die, but as a rule at least one shoot flowers. Before the tip of the primary shoot dies some leaf-spotting occurs, varied in appearance and colour. It is not known how much of this is due to zinc deficiency. The roots show no marked symptoms, but their development is generally somewhat limited. In some cases die-back of the primary shoot occurs at a later stage. In others the tip does not die, but growth is arrested, and the topmost leaves are spotted and yellowish; later, growth is resumed and the position at which arrest occurred is shown by the degree of leaf-bunching and the tendency for affected leaves, especially spotted ones, to drop.

The condition was first noted in the mid-northern area on heavy, dark lime-humus soils and has since been found on less heavy types and on 'mallee' [*Eucalyptus* bushwood] soils fringing this lower northern area. It has also been observed in the Strathalbyn area.

In 1943 field tests were conducted at two centres, in which agricultural zinc sulphate, zinc concentrate, and zinc calcine were applied at different rates, the first at 10, 20, and 30 lb. per acre, and the others at rates containing equivalent amounts of zinc. Superphosphate at 1 cwt. per acre was applied to all plots. At all stages of growth the effects of the zinc calcine and the zinc sulphate were evident, but little or no difference was noted between the different rates of application. The zinc concentrate appeared to have only very slight effect. On 27th September the results at one centre showed that the yields per acre (dry weight) were 1,400, 1,240, and 760 lb. for zinc sulphate, zinc calcine, and zinc concentrate, respectively, as against 710 lb. for the plots receiving superphosphate alone.

There is at present no detailed information as to what parts of South Australia are likely to benefit from zinc applications for flax-growing. Individual growers must determine for themselves whether they are likely to obtain a beneficial response. For the present it is suggested that growers should use a superphosphate and zinc mixture containing agricultural zinc sulphate or zinc calcine at a rate equivalent to 20 lb. agricultural zinc sulphate per acre.

Waterhouse (W. L.) & Watson (I. A.). **Further determinations of specialization in Flax rust caused by Melampsora lini (Pers.) Lev.** —*J. roy. Soc. N.S.W.*, lxxvii, pp. 138–144, 1943.

Further studies on specialization by *Melampsora lini* in Australia [*R.A.M.*, xxi, p. 256] have resulted in the determination of six physiological races. Race A is the one already recorded for Australia [loc. cit.]. It is essentially a rust of linseed varieties, on which it often causes serious damage. It is not at present important on commercial fibre flax varieties, though it is present in areas where these are grown. It occurs on *Linum marginale*, and is particularly virulent on Indian linseed varieties, of which Punjab, Bombay, and Morocco are very heavily attacked.

Races B, C, D, and E are serious pathogens on fibre flax varieties. They resemble Flor's race 21 [cf. ibid., xix, p. 655]. B and C are similar, except for a sharp differentiation by the Argentine 705 1 flax variety, which gives immune and susceptible reactions, respectively. Races D and E differ from B and C in that Kenya 709–1 is fully susceptible to them though it gives a variable or mixed reaction to B and C. At high temperatures the reactions of D and E are variable. Separation between D and E is effected by Argentine 705 1. No other variety has yet been found which will distinguish satisfactorily between B, C, D, and E. The authors agree with Flor that Argentine 705 1 is influenced by environmental conditions: when inoculated with B, C, D, and E it has shown about 20 per cent. of mixing. F has affinities with A, but it is clearly separated from it by the reaction on Buda 270–1. This race has so far been found only on *L. marginale* in Victoria and South Australia.

In contrast with the race determinations made in the United States, J.W.S. C.I. 708 1 is fully susceptible to races B, C, D, and E. A noteworthy feature of the six Australian races is that Ottawa 770B and Argentine C.I. 462 are uniformly immune from them.

When two different isolates of the teleutospores of race A were used, the aecidial stage on Punjab linseed gave reactions similar to those of the original uredospore material, indicating that some isolates of this race are homozygous.

The distribution of the six races in Australia, Tasmania, and New Zealand up to 31st December, 1942, is tabulated. That only race A occurred in New South Wales is explained on the ground that only linseed varieties are grown in this State. The uredospores of race A appear to tolerate much higher temperatures than those of the other four flax-attacking races and to survive longer periods of artificial storage at low temperatures. Victoria yields all six races.

Two species of wild flax are found in Australia. Of these, *L. gallicum* was not found to be infected, and attempts to infect it with races A, B, C, D, and E failed. *L. marginale*, on the other hand, plays an important part as a perennial host and yielded A, E, and F. Some evidence was obtained that certain strains of wild flax may serve as useful differentials of races.

Flax and linseed varieties found resistant to the different races (less than 10 per cent. of plants susceptible) are listed. A number are resistant to all six. If they become rusted when grown in various localities, the indication will be that yet another race has been found.

Crossing is in progress to combine the full resistance of certain of these parents with other desirable qualities.

HASKELL (R. J.), LEUKEL (R. W.), & OTTEN (C. J.). **Organized seed treatment to improve stands and conserve seed a part of the Government's war-time Hemp program.**—*Plant Dis. Reptr*, xxvii, 12 13, pp. 252–253, 1943. [Mimeographed.]

The results of preliminary co-operative experiments in the seed treatment of hemp, the cultivation of which is being widely extended in the United States to combat the prevailing fibre shortage, indicated an average increase of 60 per cent. in the emergence of plants from seed disinfected with organic mercury [cf. *R.A.M.*, xxiii, p. 63], while in some cases the rate was nearly doubled. Such convincing evidence in favour of seed treatment decided those entrusted with the execution of the hemp fibre programme to treat all Kentucky and Chilean seed intended for the new producing areas. No proper facilities for the work being available in the Kentucky warehouses where the seed was stored, arrangements were made for the treatment to be carried out at suitable plants in various towns of Indiana, Illinois, and Iowa served by the railways conveying the material to its northern destinations. At most of these plants semesan jr. was applied to the seed at a dosage of 1½ to 2 oz. per bush., the total quantities of Kentucky and Chilean produce treated being 200,000 and 8,000 bush., respectively. There was a general improvement in germination in tests at the Bureau of Plant Industry Station, Beltsville, Maryland, conducted four to six weeks later, and the precaution is believed to have been largely responsible for the vigour of the stands in the face of the abnormally unfavourable weather conditions obtaining in the areas under production during the spring of 1943. This is probably the first instance of the application to virtually the entire national supply of a valuable crop of seed treatment against soil- and seed-borne pathogens.

DODGE (B. O.) & RICKETT (H. W.). **Diseases and pests of ornamental plants.**—xi + 638 pp., 194 figs., 1 diag., 1 graph, Lancaster, Pa, Jaques Cattell Press, 1943. $6.50.

The first part of this book, which is designed to meet the needs of amateur and professional gardeners as well as of the commercial grower, deals with the symptomatology, etiology, and control of diseases and pests of ornamentals in general, while in the second the available information on the recognition and treatment of the pathogens of some 600 garden and greenhouse plants is summarized under the individual hosts, arranged in the alphabetical order of their scientific names.

BRIERLEY (P.). **Viruses described primarily on ornamental or miscellaneous hosts.**—*Plant Dis. Reptr, Suppl.* 150, pp. 410–482, 1944. [Mimeographed.]

The following 74 viruses are listed in alphabetical order according to the generic names of their principal hosts, with notes on their synonymy, common names, geographical distribution, host range, mode of transmission, properties, other pertinent observations, and the relevant literature, as part of a project of the Committee on Virus Classification and Nomenclature of the American Phytopathological Society dealing with the codification of published information on these subjects: *Abutilon* variegation, *Acer* (maple) variegation, *Anemone* alloiophylly, *Anthurium* mosaic, ash variegation, aster (*Callistephus*) yellows, *Atropha* mosaic, *Boltonia* streak, California aster (*Callistephus*) yellows, *Camellia* yellow spot, *Canna* mosaic, carnation mosaic, *Cephalanthus* mosaic, *Dahlia* mosaic, *Daphne* mosaic, *Datura* mosaic, *Datura* 'quercina', *Delphinium* ring spot, elder mosaic, elm mosaic, elm phloem necrosis, *Emilia* variegation, *Epiphyllum* mosaic, *Euonymus* variegation, *Gladiolus* mosaic, *Holodiscus* witches' broom, hop chlorotic disease, hop infectious sterility, hop mosaic, hop nettlehead, horse-chestnut variegation, *Hydrangea* virescence, *Hyoscyamus* mosaic, *Ilex* variegation, *Iris* mosaic,

Jasminum variegation, *Laburnum* variegation, lily rosette, lily symptomless, lily of the valley mosaic, *Lonicera* variegation, *Matthiola* mild mosaic, *Matthiola* severe mosaic, *Narcissus* mosaic, *Narcissus* white streak, oleander variegation, *Ornithogalum* mosaic, passion fruit woodiness, passion fruit variegation, peony mosaic, *Pelargonium* leaf curl, *Pelargonium* mosaic, *Peperomia* ring spot, *Petunia* mosaic, *Phlox* streak, *Phytolacca* mosaic, *Pittosporum* variegation, *Primula* mosaic, privet variegation, *Prunella* mosaic, *Prunus* rough bark, *Ptelea* variegation, *Rhamnus* variegation, *Robinia* brooming, rose mosaic, rose streak, rose wilt, *Rumex* mosaic, *Sorbus* variegation, sweet pea streak, *Tabebuia* witches' broom, and tulip breaking.

Silberschmidt (K.). **Estudos sôbre a transmissão experimental da 'clorose infecciosa' das Malvaceas.** [Studies on the experimental transmission of 'infectious chlorosis' of the Malvaceae.] — *Arq. Inst. biol. S. Paulo*, xiv, 9, pp. 105-156, 7 pl., 1943. [English summary.]

A comprehensive, tabulated account is given of the author's observations and experiments on the transmission of infectious chlorosis of *Sida acuta* var. *carpinifolia*, *S. rhombifolia*, and *S. cordifolia*, all common in the State of São Paulo, Brazil, and of two cultivated ornamentals, *Abutilon striatum* and its var. *spurium* [*R.A.M.*, ix, p. 385; xiii, p. 447].

Attempts at the transmission of the causal virus from chlorotic to healthy plants of *S. acuta* var. *carpinifolia* and *S. rhombifolia* by sap inoculation gave negative results, but the infective principle was readily conveyed by grafting from diseased to sound components of the former variety, a period of two days sufficing for the establishment of the virus in the latter species. Exposure of the viruliferous scion, before grafting, to high temperatures tends to delay the appearance of symptoms in the stock. The virus travelled more swiftly in a basipetal than in an acropetal direction. Plants grown from seed of diseased plants of *Sida* failed to yield any symptoms whatever.

In a second series of tests, involving interspecific grafts, healthy stocks of *S. rhombifolia* contracted infection with equal facility from chlorotic scions of the same host, *S. acuta*, and *S. cordifolia*. *S. acuta* stocks, however, developed graver symptoms after grafting with diseased scions of the same species than in the trials with *S. rhombifolia*, similar observations applying to *S. acuta* scions grafted on infected stocks of the same species or *S. rhombifolia*.

A third series of experiments was conducted with intergeneric grafts between *A.* and *S.* spp. Diseased scions of *A. striatum* var. *spurium* transmitted a virus capable of inducing the typical chlorotic symptoms in stocks of *S. rhombifolia*, whereas those of *S. acuta* var. *carpinifolia* reacted only very faintly to the same treatment. There were very few instances of successful transmission of the virus from diseased *S.* to healthy *A.* spp.

It is concluded from these data that the viruses responsible for infectious chlorosis in different species of Malvaceae are identical, but that passage through the zone of contact between stock and scion, in the case of heteroplastic grafts, results in a weakening of virulence, possibly associated with (*a*) insufficient quantities of the virus, (*b*) the absence of a second virus component necessary for the formation of a 'complex', (*c*) the lack of an 'activator' substance, or (*d*) the non-aggregation of the virus particles.

Finally, attention is drawn to the susceptibility to reinfection with the virus of infectious chlorosis of such organs of the grafted plants as exhibited no symptoms in the original experiments.

Smith (F. F.) & Brierley (P.). **Ornithogalum mosaic.** — *Phytopathology*, xxxiv, 5, pp. 497–503, 1 fig., 1944.

A double-flowered variety of *Ornithogalum thyrsoides* received from an Oregon

grower in 1940 was affected by a fine, pale and dark green mottling of the leaves, turning grey or yellow and becoming more prominent with advancing maturity. The flower stalks were sometimes strongly marked with sharply contrasting pale and dark green blotches, while thin, longitudinal streaks commonly developed in the white perianth segments. Similar mosaic patterns were observed in *O.* and *Lachenalia* leaves in Alabama, and on *Galtonia* and hyacinth in Oregon. The *O.* virus could be transmitted only with difficulty by means of the sap, but a high degree of efficiency in this respect was shown by *Aphis gossypii*, *Macrosiphum lilii*, *M. solanifolii*, and *Myzus persicae*, *M. circumflexus* being slightly less active than the other aphids. The numbers of plants infected mechanically and by the five species of aphids, in the order given above, were 6 out of 75, 5 out of 5, 5 out of 5, 5 out of 5, 46 out of 46, and 4 out of 10, respectively, while the corresponding minimum incubation periods were 32, 17, 10, 31, 10, and 34 days, respectively. The host range of the virus, as hitherto established, embraces only *Galtonia candicans*, Yellow Hammer hyacinth, and *L.* sp., with the possible addition of *Eucomis*. The common name of *Ornithogalum* mosaic and the technical designation of *Marmor scillearum* are proposed for the virus under observation.

Weiss (F.). **Rhododendron dieback and canker.**—*Plant Dis. Reptr*, xxvii, 12–13, p. 254, 1943. [Mimeographed.]

Three-year-old grafted *Rhododendron* plants from a Maryland nursery developed a wilt followed by death of the current season's shoots in the suburban districts of Washington early in July, 1943. A species of *Phytophthora*, tentatively referred (with the concurrence of C. Drechsler) to *P. cactorum* [*R.A.M.*, xiv, p. 173], was isolated from the diseased material, its perpetuation having apparently been effected in the 1942 internode. Portions of the infected bark immersed in water also bore numerous acervuli of the *Gloeosporium* type containing salmon-pink, aseptate, cylindrical conidia, 12 to 16 by 4·5 to 5·5 μ, borne on conidiophores measuring 18 to 20 by 4 μ, which were exuded in cirrhi under humid conditions: over some of the acervuli dark setae, 35 to 80 by 5 to 6 μ, were irregularly scattered. These features are characteristic of the conidial stage of *Glomerella cingulata*, the behaviour of which in this instance was quasi-parasitic, since it formed cankers at the end of the 1941 internodes resulting in constriction of the twigs and transverse, irregular cracking of the cortex. This is believed to be the first record of *G. cingulata* on *R.*, which is, however, subject to infection in Maryland, as well as in Europe, by *Gloeosporium rhododendri* Briosi & Cav., with characters indistinguishable from those of the imperfect stage of *Glomerella cingulata*.

Sprague (R.). **Root rots of Gramineae in the Northern Great Plains, 1940–43.**—*Plant Dis. Reptr*, xxvii, 12–13, pp. 248–250, 1943. [Mimeographed.]

The results of inoculation experiments during the winter of 1942–3 showed that *Pythium arrhenomanes* is the most important parasite of grasses in the Northern Great Plains [*R.A.M.*, xxiii, p. 263], but other fungi implicated in pre-emergence killing include *Helminthosporium sativum*, *P. debaryanum*, *P. ultimum*, *P. irregulare*, and *Fusarium scirpi* var. *acuminatum*, of which the *P.* spp. are also responsible for root necrosis and stunting in sorghums, millets, and some small-seeded grasses. The use of 20 'indicator' hosts for inoculations with *P. debaryanum* showed that the rotation problem is considerably complicated by the varying pathogenicity to different crops of the several isolates, those from Gramineae, for instance, destroying many of the non-grass 'tester' hosts and vice versa. To cite one example, old orchard soil clean-cultivated for 25 years at Mandan, North Dakota, contained sufficient inoculum of the fungus to reduce the emergence of Turkestan lucerne, Turghai proso millet [*Panicum miliaceum*], Rival wheat, and Standard crested wheatgrass [*Agropyron cristatum*] by 50, 55, roughly 0, and 16 per cent.,

respectively. Some of the 'indicators', e.g., *Bromus arvensis* and *B. tectorum*, proved highly resistant to *Pythium arrhenomanes* but susceptible to certain isolates of *P. debaryanum* at the time of seed germination. *P. arrhenomanes* shows little tendency to physiologic specialization in the region under observation, but one aberrant form isolated from irrigated barley in South Dakota was highly pathogenic to the normally resistant *A. intermedium*, in which it caused 98 per cent. loss, the corresponding figures for wheat and *A. cristatum* being 61 and 100 per cent., respectively. The ordinary isolates of the same fungus caused the following stand reductions in greenhouse trials from October to February: *A. cristatum* 60 to 100 per cent., *Panicum miliaceum* 95 to 100, blue grama [*Bouteloua oligostachya*] 100, Victory oats 4 to 20, wheat 8 to 30, *Bromus tectorum* 20 to 30, *B. inermis* 30 to 90, *Elymus canadensis* 30 to 60, Black Amber sorghum 45 to 65, and *A. intermedium* 40.

Pythium tardicrescens [ibid., xix, p. 696] was isolated in 1942 from oats in Washington and *Echinochloa crus-galli* in Minnesota, this being apparently the first report of its occurrence south of the Canadian prairies. The reaction of the 'indicators' to the organism was generally similar to that induced by *P. arrhenomanes*.

Attempts at the control of *P.* spp. by various soil amendments gave disappointing results, but seed treatment with semesan and spergon proved beneficial against root rot of *Panicum miliaceum* and *Bouteloua oligostachya*. At Mandan, Russian wild rye (*E. junceus*), *A. cristatum*, *Bromus inermis*, and other cool-temperature grasses largely escape seedling blight if sown in the autumn.

Nilsson-Leissner (G.). **On the possibilities of breeding new strains of Timothy by means of selfing.**—Abs. in *Hereditas*, xxviii, 3-4, pp. 500–502, 1942. [Received September, 1944.]

The experiments on selfing in timothy [*Phleum pratense*] as a means of improving various characters, including resistance to rust [*Puccinia phlei-pratensis*], the principal disease of the crop in Sweden, were planned and largely carried out by N. Sylvén at the Herbage Plant Department, Swedish Seed Association, Svalöf, and a detailed report of the work was prepared by G. Julén for *Sveriq. Utsädesfören. Tidskr.*, 1942. In 1939, when the disease assumed a very severe form, enhanced susceptibility was general among the inbred plants, the differences being particularly obvious between the P and I_1 generations. Certain strains, however, showed a high degree of resistance throughout the investigations (which were initiated in 1926), and it is therefore concluded that the increased susceptibility to infection caused by inbreeding could be obviated by selection.

Laubert (R.). **Lagerfäulen des Obstes.** [Fruit storage rots.]—*Kranke Pflanze*, xxi, 1–2, pp. 2–4, 1944.

Popular notes are given on the fruit storage rots caused by *Monilia* [*Sclerotinia*] *fructigena*, *Botrytis cinerea*, and *Penicillium glaucum*, all of which are stated to be important and widespread in Germany. Preventive measures should include the the rough cleansing of storage rooms by whitewashing the walls, washing the stands, cribs, &c., with soda water or formalin solution, and fumigating with sulphur; exclusion from storage of any bruised or otherwise damaged or diseased fruits; and the maintenance of a temperature between 3° and 6° C. and of moderate atmospheric humidity.

Mills (W. D.). **Fruit diseases in 1943.**—*Proc. N.Y. St. hort. Soc., 1944*, pp. 18–26, 1944.

Notes are given on the prevalence and severity of fruit diseases in New York during 1943, and on the effects of the different routine treatments applied.

Spraying schedules for 1944.—*Proc. N.Y. St. hort. Soc., 1944*, pp. 299–321, 1944.

Spraying schedules for use in New York in 1944 are given against pests and diseases of apples, pears, cherries, peaches, and grapes.

Brown (D. S.). **Notes and observations from a study of water core in Illinois apples during the 1942 season.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 267–269, 1943.

A study of apple water core [*R.A.M.*, xviii, p. 687; xix, p. 353] indicated that the name is something of a misnomer. In most varieties examined the affected tissues were largely confined to the cortex, Winesap and Stayman Winesap being the only ones in which they were mainly in the core. Also, other materials than water appeared to be involved. Incidence was always associated with vascular tissues. In most varieties, water-cored areas first appeared round the toral bundles or the traces that diverge from them into the flesh. In Winesap and Stayman Winesap, the ventral carpellary bundles were involved, particularly in the region near the stem where the toral bundles and the carpellary bundles emerge. The amount of starch in the affected areas appeared in all cases to be at least equal to that in the unaffected tissues. Water core was noted in some apples long before there was any sign of a decrease in starch anywhere in the cortex. As the fruit matured, the regions round the vascular supply to the cortex were among the last to be freed from starch, and these were the same areas in which water core first appeared.

In general, the number or proportion of affected apples increased as the fruit became more mature. Fruit exposed to sunlight was, on the whole, more affected than shaded fruits. Affected apples were higher in percentage of dry matter than unaffected apples picked at the same time. The juice from affected fruits was usually higher in soluble solids and lower in titratable acid than juice from unaffected apples. On a basis of individual apples, the water-cored tissues were not consistently higher, were, indeed, often lower in soluble solids than the unaffected tissues of the same apple, which also indicates that the starch to sugar conversion is not important in relation to incidence of water core.

Other observations suggested that the source of the trouble is not in the apple itself. Many affected fruits showed guttation through the lenticels. It seems likely that something happens in the tree, in the spur or cluster base, that causes an influx of water and solutes into the apple under pressure, with a resultant filling of the intercellular spaces of the cortex or core, characteristic of water core.

Southwick (L.). **Magnesium deficiency in Massachusetts Apple orchards.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 85–94, 4 figs., 1943.

Foliage scorch due to magnesium deficiency has become serious in certain apple orchards in Massachusetts [cf. *R.A.M.*, xx, p. 559; xxii, p. 437]. Other symptoms noted included yellow banding and mottling of leaves, sudden, premature dropping of older affected leaves, and pre-harvest shedding of fruit. The symptoms, however, differed widely with the varieties; in two greenhouse-grown Malling stocks, one showed characteristic leaf edge burn and the other interveinal scorch.

Chemical analysis of unburned leaves revealed a consistent correlation between symptom severity and the magnesium and potassium content. There was strong evidence to suggest that potassium fertilization leads to increased prevalence and severity of magnesium deficiency symptoms. Data from four varieties indicated that, on a basis of dry matter, a magnesium content of 0·25 per cent. is near the critical level in apple foliage. This amount failed to prevent deficiency symptoms when the potassium level was very high. The soils concerned were quite acid, and contained very small amounts of exchangeable magnesium, analyses of surface soil showing only 6·3 parts of exchangeable magnesium per million parts of dry soil. Chemical analysis of apple leaves would appear to offer an accurate, direct

method of determining the magnesium status of apple trees. Where severe deficiency symptoms prevail, a magnesium fertilization programme should be adopted and the use of potassium discontinued for a time.

Boynton (D.), Cain (J. C.), & Van Geluwe (J.). **Incipient magnesium deficiency in some New York Apple orchards.**—*Proc. Amer. Soc. hort. Sci.*, xlii. pp. 95–100, 1 fig., 1943.

Several New York apple orchards show a condition apparently due to magnesium deficiency. In July or later, a fading occurs between the veins of the older leaves on some shoots or spurs. The faded areas in McIntosh and Cortland trees often turn pale yellow, but loss of green colour does not proceed so far in Baldwin and Northern Spy leaves before the faded zones die. In all these varieties, necrosis follows the fading and produces typical brown blotches between the veins. When the fading is near the margin, several blotches may overlap, producing marginal scorch. The older leaves may shrivel and abscise by early September, leaving the branch bare except for a few leaves close to the terminals of the shoots. Heavy pre-harvest drop of the fruit ensues, the fruit failing to mature normally. In one orchard, however, the trouble has persisted for over 15 years with no apparent adverse effect on blooming or vegetative growth.

Injections of Epsom salts [magnesium sulphate] appeared to arrest the development of the symptoms, but small overdoses caused severe injury to the current season's leaves, and moderate doses appeared to have only a temporary effect. When moderately affected 18-year-old Cortland trees were sprayed with 2 per cent. Epsom salt solution four times at intervals of two weeks, starting in mid-June, leaf blotch appeared on 10 per cent. of the sprayed trees and 95 per cent. of the controls. The disorder was also controlled by soil applications (at various rates) of magnesium sulphate.

Hamilton (J. M.) & Palmiter (D. H.). **Apple scab, Cedar-Apple and Quince rust, fruit russet, and Cherry leaf-spot in 1943.**—*Proc. N.Y. St. hort. Soc., 1944*, pp. 27–34, 1944.

During 1943, when rain fell almost continuously during the spring, McIntosh apple orchards in the Hudson Valley, New York, with a heavy carry-over of scab [*Venturia inaequalis*] from the previous season were sprayed with eight fungicides in a comparative test control. As a result of infection, the unsprayed trees dropped all their fruit before July. Of eight sprays applied, lime-sulphur caused considerable drop, while wettable sulphurs gave commercial control of the disease without injury or reduction in yield. In two orchards all the fruits on the unsprayed trees were infected, whereas lime-sulphur (1½–100 plus 3 lb. lime) gave 4 and 3 per cent. infection, respectively. Flotation sulphur pastes (4 lb. sulphur per 100 gals.) were nearly as effective as lime-sulphur and were superior to dry wettable sprays with a higher sulphur content. Camden paste 6–100 (2·1 lb. sulphur per 100 gals.) was about as effective as the best dry-wettable 5–100, containing more than twice as much sulphur. Fermate (1½–100) with 17 and 14 per cent. infection was comparable with the better dry-wettable sulphurs, but its use in the first or second cover sprays or at ½ or ¾–100 with self-emulsifying cottonseed oil gave better scab control than a continuous sulphur schedule. When Rome Beauty apples were sprayed against cedar-apple rust [*Gymnosporangium juniperi-virginianae*: *R.A.M.*, xxii. p. 486] and quince rust [*G. clavipes*: ibid., xix. p. 28] at the pink, bloom, calyx, and 10-day stages, micronized 3 and fermate ½–100 gave 99 per cent. control of each disease on the fruit, fermate 1–100 giving 97 and 99 per cent. control, respectively, as against 100 per cent. fruit infection by both diseases in the unsprayed controls. When Cortland apples were sprayed against scab and quince rust with micronized 3 and fermate ½, 1 and 7 per cent. fruit infection (scab and

rust, respectively) resulted, as against 100 and 20 per cent. for the unsprayed controls.

Comparative spraying tests against cherry leaf spot [*Coccomyces hiemalis*: ibid., xxii, p. 289] were made on a block of Montmorency trees with a heavy carry-over of inoculum. The cluster and two to three basal terminal leaves had moderate infection before spraying started. Four applications were made before harvest, beginning with the shuck, and one after picking. On 20th October no leaves remained on the terminals of the controls, as against 82 per cent. for microgel 1½ + lime 3–100, and 81 per cent. each for cupro K3 + lime 3 + orthex 1 pint, COCS [copper oxychloride sulphate] 1½ + lime 3–100 + orthex 1 pint, and Bordow 4 + lime 3–100. Fermate 1½–100 with or without lime was as effective as Bordow in the pre-harvest sprays but should not be applied afterwards.

Marshall (R. P.). **Control of Cedar-Apple rust on Red Cedar.**—*Trans. Conn. Acad. Sci.*, xxxiv, pp. 85–118, 5 pl., 2 diags., 1941. [Received September, 1944.]

Of the various materials tested since 1930 for the control of cedar-apple rust (*Gymnosporangium juniperi-virginianae*) on red cedars at Stamford, Connecticut, Keitt and Palmiter's Bordeaux No. 180, which has a high copper-lime ratio (12 : 8) and contains zinc arsenite (8 lb. per 100 gals.) [*R.A.M.*, xvii, p. 118], gave the best results. In 1938, when three treatments were given, the first on 14th April, the second on 27th July, and the third on 10th August, the degree of control obtained was estimated at 98 per cent., the corresponding figures for 1939 and 1940 being 90 and 80 per cent., respectively; in the two latter years the spray was applied only once (on 13th April or 3rd May in 1939 and on 17th May in 1940). The average dosage per tree was 4 gals. in 1939 and 2 in 1940. Not only did the treatment prevent the production of new galls by the rust, but it inhibited sporidial formation by those already present.

Weber (A. L.) & McLean (H. C.). **Spray coverage of Apple trees as affected by different methods of application.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 285–288, 1943.

Studies made to determine coverage (by analysis of leaf samples) on apple trees sprayed by different types of equipment showed that the speed sprayer, in which the spray material as it comes from the nozzles is forced into the tree by a current of air from a propeller, is highly efficient if used properly, and greatly reduces labour. With this apparatus, one grower with three men sprayed his orchard in four days, using one sprayer, although the year before, using the conventional type of sprayer, he had needed seven men and two spray rigs to complete the work in six days in the absence of adverse winds. With the speed sprayer such winds did not prevent efficient coverage. Other growers reported similar experiences.

Wilkinson (E. H.). **Bitter rot of Apples caused by Gloeosporium album Osterw., with special reference to the variety Allington Pippin.**—*Rep. agric. hort. Res. Sta. Bristol, 1943*, pp. 81–89, 2 figs., [1944].

A study of the lenticel rotting of apples of many commercial varieties grown in Somerset, Kent, Cambridgeshire, Worcestershire, Herefordshire, and Cheshire and kept in cold storage at Long Ashton was made during 1937–9. Four fungi were found responsible, viz., *Cylindrocarpon mali*, *Gloeosporium fructigenum*, *G.* [*Neofabraea*] *perennans*, and *G. album* [*R.A.M.*, xxiii, p. 66]. The first three occurred only occasionally, whereas *G. album* [ibid., xx, p. 475; xxii, p. 363] was isolated consistently, and proved to be the major cause of lenticel rots.

On apple fruits *G. album* (causing bitter rot) usually appears in storage during

the latter part of November, but it has been found to attack Allington Pippin apples on the tree in mid-October. Its development is essentially the same on all varieties. The first symptom is a pale brown or purple marking of the lenticular tissues and the immediately adjacent skin. At the close of the first stage of radial expansion the lesions are uniformly brown, 3 to 5 mm. in diameter, and each has a lenticel at its focus. Radial development progresses slowly until lesions 8 to 50 mm. in diameter are formed, size depending on the number of separate infections on each fruit. The lesions are circular, flattened or concave, and skin-smooth; the margins are sharply defined, and each has a light brown centre surrounded by a darker brown marginal zone. Occasionally lesions are seen with two sets of light and dark brown bands or with a uniform colour and no zonation. Sporing bodies arise subepidermally, raising the skin into small pimples. They burst through the skin and appear as small, white, wax-like bodies which, in mature rots, are arranged concentrically round the central lenticel, and release white masses of spores in a mucilaginous matrix. Bitter rot caused by *G. album* can be distinguished from lenticel rots due to *N. perennans* only by spore examination. The number of bitter-rot lesions on a single fruit ranges from one on such varieties as Bramley's Seedling to over 200 on terminal fruits of Allington Pippin.

In the orchard the fungus is present on small dead twigs and pruning snags. The author has not observed it to form small cankers. The only certain method of detecting its presence is to incubate suspected snags in moist conditions and observe the exudation of glutinous, white spore masses over the surfaces.

During 1937–8 the author examined 21,600 apples of all the popular commercial varieties, and found that 15·41 per cent. of the fruits were affected; in 1938–9, of 12,822 apples examined, 8·16 per cent. were infected. The identity of *G. album* was established in each case. Counts in 1937–8 suggested that degree of incidence depends on the variety, Worcester Pearmain, Cox's Orange Pippin, Laxton's Superb, Grenadier, Bramley's Seedling, and Newton Wonder showing, respectively, 46, 38, 8, 15, 3, and 2 per cent. infection.

Inoculation experiments showed that *G. album* is non-parasitic to living apple twigs, but the fungus can form mycelial cushions on dead twigs beneath the bark, suggesting a rudimentary type of acervulus. Isolates from both apple fruit and infected twigs when inoculated into apple fruits proved the fungus to be an active agent of decay. When mycelium was applied to apple scab (*Venturia inaequalis*) lesions, marginal rots resulted, showing that the fungus can also penetrate the skin in this way. No rots developed, however, when scab lesions were treated with spore suspensions.

Numerical data from 34,000 apples in cold storage at Long Ashton in 1937–9 showed that *G. album* was the most important rot-producing fungus present in that period. Only minor losses resulted from its entry through skin injuries and scab lesions, its main method of attack being through the lenticels. When individual healthy lenticels, or those previously treated with strong ammonia vapour, were inoculated with spore suspensions in the laboratory, no infection resulted after eight weeks. Under natural storage conditions, however, *G. album* does penetrate the lenticels, so that certain changes in these structures must take place to permit entry. Isolations from lesions of all sizes on Allington Pippin apples showed that 37·3 per cent. of those with diameters up to 3 mm. yielded no fungi, whereas lesions with diameters over 3 mm. all gave mycelial growth, with *G. album* present to the extent of 78·7 per cent. Probably, therefore, in this variety the initial stage of many of the lenticel rots is non-parasitic, and the fungi which eventually cause the true lenticel rots, especially *G. album*, are able to penetrate the tissues only because the lenticels have been affected by some form of physiological breakdown, the causes of which are as yet unknown. Climatic factors may, it is thought, play some part in certain seasons.

Mundkur (B. B.). & Kheswalla (K. F.). **A canker of Apple trees in Mysore.**—*Indian J. agric. Sci.*, xiii, 4, pp. 397–398, 1 pl., 1943.

Young apple trees imported from Australia developed, within a fortnight of their arrival in Mysore, a canker of the twigs due to *Sphaeropsis malorum* [(Berk.)] Berk. (*Physalospora mutila* fide N. E. Stevens) [*R.A.M.*, xv, p. 726]. The pathogen is believed to have been introduced into India with the material in question, and the tentative record by Mitter and Tandon of this species [ibid., ix, p. 392] is considered to have been erroneous. The morphology of the Mysore fungus leaves no doubt as to its identity with *S. malorum* (Berk.) Berk. The coarsely granular, thick-walled pycnospores of the former are hyaline and measure 14·4 to 23·4 by 10·8 to 14·4 μ while still enclosed in the pycnidium, after extrusion from which they turn tan or brown, develop a single septum, and measure 16·2 to 23 by 9 to 12·6 μ, being thus slightly shorter and broader than the European strain. A certain resemblance is apparent between this Indian collection of *P. mutila* and *Glutinium macrosporum*, described by Zeller as the agent of an apple and pear canker in Oregon [ibid., vi, p. 735].

While the above note was in the press, a statement by E. W. Mason *in litt.* that the Mysore spores are consistently smaller than those of the European species, *S. malorum* (Berk.) Berk., and therefore do not belong to this species, made advisable a further comparison with Australian material already referred to that species. This was furnished by Dr. C. J. P. Magee. The dimensions of the extruded spores from the type specimen from Great Britain (*fide* E. W. Mason) are 23 to 28 by 10 to 12 μ and those of the Australian specimens 14·4 to 23·4 by 9·2 to 14·4 μ, the latter thus agreeing very closely with the Indian material. One of the Australian twigs bore perithecia and eight-spored asci, possibly representing the perfect stage of the fungus.

McColloch (L. P.). **Sporonema rot of Apples.**—*Phytopathology*, xxxiv, 4, pp. 437–439, 1 fig., 1944.

Sporonema oxycocci, the agent of a cranberry storage rot [*R.A.M.*, xix, p. 25], was observed in 1936 to be causing decay of a York Imperial apple held at 36° F. in the same room as cranberries. In further studies on apple storage rots at the Bureau of Plant Industry Station, Beltsville, Maryland, the same organism was again isolated from diseased fruits and inoculated through wounds into healthy York Imperials with positive results at 31°, 36°, and 50°. At the lowest temperature the rot developed slowly, but in the course of several months of storage the lesions assumed serious proportions. At 50° the decay was darker than at 31°, the underlying tissues being, in fact, quite black. Mature pycnidia were formed at 36°, but not at 31°; they originate below the peel and become erumpent through it. On Thaxter's agar the colonies attained a maximum diameter in 24 days of 79·5 mm. at 77°.

Bryant (L. R.) & Gardner (R.). **Phosphorus deficiency in Pears.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 101–103, 2 figs., 1943.

Pear trees of the Bartlett, Anjou, Kieffer, and other varieties in parts of an orchard east of Clifton, Colorado, developed a serious condition in 1939, characterized by severe burning of the margins and the tip halves of the leaf blades early in the growing season, decrease in leaf size, failure of the fruit to develop properly, very short terminal growth, a scaly appearance of the bark, and a dying-back of the new growth.

Early in the spring of 1942, 30 seriously affected Kieffer trees were given the following treatments put down to the root zones in auger holes 12 in. to nearly 3 ft. deep: sulphur (5, 10, 15 lb. per tree); treble superphosphate (5, 15, 25 lb.); potassium chloride (2, 6, 10 lb.); sulphur 5 lb. plus treble superphosphate 5 lb.;

sulphur 10 lb. plus treble superphosphate 10 lb.; sulphur 15 lb. plus treble superphosphate 25 lb.; treble superphosphate 5 lb. plus potassium chloride 2 lb.; treble superphosphate 15 lb. plus potassium chloride 2, 6, and 10 lb.; treble superphosphate 25 lb. plus potassium chloride 10 lb. When treble superphosphate was used, alone or in the combinations, striking recovery took place. Even the lowest phosphate application gave a definite improvement. Sulphur used alone also produced satisfactory improvement when not less than 10 lb. per tree was applied. The combination of sulphur with treble superphosphate gave good improvement when as little as 5 lb. of each was used, heavier applications giving excellent results. The potassium fertilizers, alone or in combination, gave no apparent benefit.

Soil tests having demonstrated that sulphur was not deficient, it is concluded that the trouble was due to phosphate deficiency and that the benefits from sulphur resulted from a decrease in alkalinity and consequent increase in available phosphorus in the soil.

Ludwigs. **Steinsucht der Birnen.** [Stony pit of Pears.]—*Kranke Pflanze*, xxi, 1–2, p. 15, 1944.

During the dry, hot summer of 1943 pears in Germany suffered extensively from 'stony pit' [*R.A.M.*, xx, p. 6]. 'Nests' of cells with hard, woody walls, embedded in the flesh, were found in such quantities that they frequently ruptured the skin and were extruded in crumbling masses; the palatibility of the fruit was impaired and its grade lowered. Stunting and malformation are not infrequent accompaniments of the disorder, which may be combated by thinning out the fruits to reduce the demand for water or by plentiful irrigation during the dry spell.

Hunter (A. W. S.) & Davis (M. B.). **Breeding rust resistant Black Currants.** *Proc. Amer. Soc. hort. Sci.*, xlii, pp. 467–468, 1943.

A search for suitable black currant varieties for use in breeding against white pine blister rust (*Cronartium ribicola*) was begun at Ottawa in 1935. One bush, identified as *Ribes ussuriense*, has never shown any sign of infection. It is of vigorous habit, but the fruit is small and unpalatable. Of the remaining varieties in the plantation, several plants of the Colorado currant, tentatively identified as *R. aureum* and *R. odoratum* were the least susceptible. In 1938 and 1939 crosses were made between all these and the standard varieties Boskoop Giant and Kerry, both derived from *R. nigrum*.

The seedlings from these crosses have never been sprayed. The year 1942 favoured infection, and the susceptible plants were easily recognized. In the black currant inheritance of resistance appears to be dominant to susceptibility. The plant of *R. ussuriense* used appears to be homozygous-resistant. The plant assigned to *R. odoratum* appears to be homozygous-susceptible, and that assigned to *R. aureum* heterozygous-susceptible. Only a few of the seedlings have fruited, but all have shown a marked resemblance in fruit characters to the cultivated parent; one seedling is particularly outstanding. Most of the seedlings are susceptible to powdery mildew (*Sphaerotheca mors-uvae*), though some are only slightly affected. Susceptibility to powdery mildew is not correlated with susceptibility to white pine blister rust.

Meredith (C. H.). **The antagonism of soil organisms to Fusarium oxysporum cubense.**—*Phytopathology*, xxxiv, 4, pp. 426–429, 1944.

Of the organisms, mostly Actinomycetes, isolated from 66 soil samples collected in four localities of Jamaica, 122 were found to be antagonistic in Newry soil solution-agar cultures to *Fusarium oxysporum* var. *cubense*, the agent of Panama disease of bananas [*R.A.M.*, xxii, p. 393]. The degree of inhibition exerted by the

soil organisms was variable, 66 retarding the growth of the parasite weakly, 39 moderately, and 17 actively. The inhibitors, moreover, were irregularly distributed in the 66 soil samples, of which ten contained 44·2 per cent. Some of the organisms arresting the development of *F.o.* var. *cubense* in their own soil solution-agar failed to do so on transference to cultures prepared from other samples.

Da Costa (E. W. B.). **Diseases of the Papaw.**—*Qd. agric. J.*, lviii, 5, pp. 282–293, 10 figs., 1944.

The most serious papaw disease in Queensland is die-back [*R.A.M.*, xx, p. 152], which appears to be due to failure of the roots to absorb sufficient water. The condition is distinguishable from other types of injury with similar symptoms by the browning and death of the young crown leaves before any other tissue is much affected, and the presence of a hard, black scab near the tip of the stem. Occurrence is sporadic and most of the losses are sustained in severe outbreaks of a few weeks' duration. These occur simultaneously over large areas and appear to be due to weather conditions. While all parts of south-eastern Queensland are affected, the severity of incidence varies markedly, not only between districts, but also from farm to farm in an affected area. In selecting sites for papaw plantings, badly drained ground should be avoided, as also should sites with a clay subsoil coming close to the surface. The physical condition of the soil should be improved by drainage, liming, and the incorporation of organic matter. Judicious irrigation will also reduce losses. As affected plants sometimes recover and produce healthy branches, the trunk should be cut back as soon as the condition is noticed.

Yellow crinkle [ibid., xviii, p. 502], which appears to be of virus origin, is very widespread in south-eastern Queensland, and in many areas constitutes a limiting factor in the commercial life of a plantation. It develops chiefly in summer, and appears to spread most rapidly in hot, dry weather. It occurs in all papaw-growing areas and on almost every farm.

Trunk rot, a soft wet rot under the almost intact bark, generally just above ground-level, is caused by a number of fungi, including *Ascochyta caricae* and *Pythium* spp. [cf. ibid., xiv, p. 216], which gain entrance at weak points. The best method of control is to improve the general health of the plant by suitable cultural methods. Care should be taken to avoid injuring the base of the trunk. If only a small part of the trunk is affected, the diseased tissue may be cut out and the cut surface painted with Bordeaux paste or Stockholm tar. If the rot occurs in the upper part of the tree, it may be advisable to cut back the trunk to some inches below the affected area.

Root rot is caused by a number of fungi, including *Pythium* spp. and *Fusarium* spp., but is primarily brought about by a poor physical condition of the soil. Control depends largely on soil improvement; sanitation is important, and all affected seedlings should be dug out and burnt, replanting in the same hole being avoided or at least delayed.

Powdery mildew (*Sphaerotheca* sp.) [ibid., xx, p. 152] may be controlled by sulphur treatments at intervals of three or four weeks from late May to October.

Fruit spot, due chiefly to *Gloeosporium* spp., *A. caricae*, and *Phomopsis* spp. [loc. cit.], may be minimized by removing and destroying all rotting fruits and as many dead stalks as possible, planting the trees in sheltered places, and maintaining a vigorous growth in winter. The fruit should be picked as ripe as possible (with due regard to destination), and should be kept in cool, well-ventilated conditions during storage and transport. If necessary, spraying should be effected at intervals of three weeks from early January to late April and at monthly intervals from early August to October, using a home-made cuprous oxide mixture, or a suitable proprietary substitute, at a strength of 0·1 per cent. copper. Bordeaux mixture itself should not be used.

Black spot (*A. caricae*) [ibid., xvii, p. 259] seldom causes serious loss if the trees are kept in vigorous growth. Incidence may be reduced by removing dead leaf stalks and rotting fruit, and thinning out overcrowded fruit. If losses become serious, effective control may be obtained by applying a protective copper fungicide (of type used against fruit spot) at monthly intervals from May to October.

Fruit rot due to *Rhizopus nigricans* [*R. stolonifer*] may be controlled by improved sanitation and careful handling.

MARTEN (E. A.) & LEACH (J. G.). **Some factors influencing the solubility of cuprous oxide in relation to its toxicity as a fungicide.** —*Phytopathology*, xxxiii, 5, pp. 459–470, 1944.

Using *Pythium debaryanum* as a test organism, the authors studied the influence of certain factors on the solubility and toxicity of cuprous oxide. The growth of the fungus in a standard liquid medium was inhibited by the compound at a concentration of 0·3 to 0·5 p.p.m. copper in solution. As much as 0·6 to 0·8 p.p.m. copper was brought into solution by the prolonged action of doubly distilled water, while ordinary laboratory-distilled water dissolved 1 to 2 p.p.m.

The solubility of cuprous oxide is greatly enhanced by glycine and other nitrogenous products of protein decomposition, 2,200 p.p.m., for instance, being liberated by the addition to the medium of 1 per cent. glycine, which, however, raised the threshold of toxicity (the smallest amount of copper required to inhibit the growth of *Pythium*) from 0·3 to 225 p.p.m.

A 1 per cent. suspension of soy-bean flour increased the solubility of cuprous oxide to 125 p.p.m. of copper. The copper thus dissolved inhibited the growth of *P. debaryanum* when diluted to 0·6 p.p.m., but the admixture with the diluted solution of 0·1 per cent. soy-bean flour increased the threshold of toxicity to between 2 and 3 p.p.m. while 1 per cent. of the flour deprived the compound of its fungicidal properties altogether.

It is thought probable that the presence in arable soils of nitrogenous products of bacterial decomposition may influence the solubility of cuprous oxide used as a seed protectant and thus account for some of the variability in the results of treatment with this compound. It is apparent from the outcome of these trials that the evaluation of protein-containing supplements demands caution, since an excess of such substances may decrease fungicidal efficacy, while smaller amounts, by increasing solubility, may simultaneously raise the fungicidal value of copper compounds.

MARSH (R. W.). **The use of copper sebacate as a foliage spray.** —*Rep. agric. hort. Res. Sta. Bristol, 1943*, pp. 77–80, [1944].

In tests in 1943 it was found that copper sebacate [*R.A.M.*, xxiii, p. 47], mixed dry with agral II or sulphite lye powder and subsequently added to water, readily dispersed to a finely divided suspension of satisfactory stability. The proportion of sebacate to wetter had to be such that on dilution the copper content of the spray, the stability of the suspension, and the wetting power should all be adequate for the spray treatment required. These conditions were met by a mixture of 4 lb. copper sebacate with 2 lb. agral II in 100 gals. water (i.e., 0·4 per cent. Cu, 0·2 per cent. agral II, by weight). This spray was ascertained to be inferior in tenacity to a Bordeaux-agral spray consisting of Bordeaux mixture 8–12–100 to which agral II was added at the rate of 2 lb. per 100 gals., when applied to onion plants, but it was at least as effective as the latter against black currant leaf spot [*Pseudopeziza ribis*] (mean percentage of leaves retained 54 ± 5, as against 45 ± 5 for Bordeaux mixture and 11 ± 2 for the unsprayed control, the difference between the two sprays not being significant).

Salvin (S. B.). **Influence of zinc oxide on paint molds.**—*Industr. Engng Chem.*, xxxvi, 4, pp. 336–340, 1 fig., 4 graphs, 1944.

Spores of paint moulds, including *Aspergillus niger*, *A. flavus*, *Cladosporium herbarum*, and species of *Phoma*, *Penicillium*, and *Dematium*, were sown on a number of paint vehicle constituents, of which raw linseed oil afforded the most luxuriant growth at 25° C. For studies on the influence of nine types of zinc oxide [*R.A.M.*, xxiii, p. 183] on fungal germination, two moulds were chosen with large, black spores and pale germ-tubes to facilitate microscopic observations, viz., *Macrosporium* [*Stemphylium*] *sarciniforme* and *Stachybotrys lobulata*. The inhibition of growth was found to be a direct function of the surface area of the chemical, a fine-particle-size zinc oxide being particularly effective; spore germination in cultures of the two organisms to which the compound was added at a dosage of 0·1 per cent. amounted to 21·7 and 14·4 per cent., respectively, compared with 98·7 and 98·9 per cent., respectively, in the controls. However, zinc oxide, although able to prevent mycelial growth or spore germination, is incapable, as shown by tests on *C. herbarum*, of actually destroying the spores, which were still viable on transference to Czapek-Dox nutrient agar after three weeks' exposure to the chemical. Zinc oxide, therefore, should properly be termed 'fungistatic' rather than 'fungicidal'. Respiration studies on *A. niger* indicated that the zinc ion affects the carbohydrate metabolism of the fungus, and it is this property, no doubt, that is basically responsible for the observed fungistatic action of zinc oxide.

Barker (H. D.), Greathouse (G. A.), & Marsh (P. B.). **The problem of standardizing test methods for mildew and rot resistant treatments of textiles.**—*A.S.T.M. Bull.* 126, pp. 32–34, 1944.

Some of the problems connected with the highly complex operations involved in the testing of fungicides for the prevention of textile rots and mildews are briefly discussed and the following conclusions reached. Evaluation tests should determine (1) whether the protective agent possesses fungicidal or fungistatic properties; (2) the degree of its resistance to leaching, photochemical action, ionic adsorption, and other weathering agencies, the prolonged action of which tends to reduce the concentration on the fabric to a value permitting the growth of deleterious micro-organisms; and (3) the amount of the antiseptic required to assure practical service life for the treated materials. In contrast to the detailed investigations necessitated by these sensitive procedures, acceptance tests should be based on rapid routine methods, capable of detecting 'spotty' application or confirming the correctness of the treatments given.

One possibility felt by the writers to have been insufficiently explored is the substitution of simple quantitative chemical for biological tests as acceptance procedures.

Eastwood (T. M.). **Bacteriostatic and fungistatic action of some organic chemicals.**—*Science*, N.S., c, 2584, pp. 10–11, 1944.

Observations made in 1940 indicated that various bacteriostatic and fungistatic organic chemicals offer a means of separating bacteria and fungi in pathological organism isolation work. Anisic acid (150 p.p.m.), benzoic acid (150 p.p.m.), and, possibly, chrysoidine Y (60 p.p.m.) selectively inhibited bacterial growth. Chlorothymol (60 p.p.m.) and hexylresorcinol (60 p.p.m.) selectively inhibited fungal growth. Sodium 2-, 4-, 5-trichlorophenate (10 p.p.m.), 8-hydroxyquinoline sulphate (10 p.p.m.), and sodium ortho-phenylphenate [tebecit] (60 p.p.m.) produced variable fungistatic action.

Baker (Gladys E.). **Heterokaryosis in Penicillium notatum.**—*J. Bact.*, xlvii, 6, p. 581, 1944.

Heterocaryosis is established in *Penicillium notatum* shortly after spore germination through anastomoses, or it may already be in existence at this stage if, as occasionally happens, the germinating conidium is binucleate. Germination is effected by means of one or two germ-tubes, and a single conidium may give rise to a homo- or heterotypic colony, according to its original uni- or binucleate character. Mass spore transfers result, in 12 to 24 hours, in numerous anastomoses, which assure a free intermingling of cytoplasm and nuclei, thereby introducing different genetic combinations into the colony and making it heterotypic.

The maintenance of an active penicillin-producing strain of the mould [*R.A.M.*, xxiii, p. 141] is a long-standing problem, since monospore transfers afford no guarantee of constancy. If activity depends on heterocaryosis, mass spore transfers would appear to provide the best means of achieving this condition, since the likelihood of isolating a single binucleate, heterotypic spore is remote.

Steinberg (R. A.). **Variants in fungi: formation, reversion and prevention.**—*Science*, N.S., c, 2584, p. 10, 1944.

Variant strains of *Aspergillus niger* obtained by chemical induction [*R.A.M.*, xxi, p. 468] were found to revert to normal when grown on high concentrations of amino acids, particularly lysin. Loss in ability to differentiate was attributed to upsets in the characteristic basal complement of enzymes employed in the utilization of amino acids in the normal strain. *A. niger* has been maintained in stable condition for 27 years under laboratory conditions. It is suggested that the use of amino acids may assist in the recovery of the normal strain of *Penicillium notatum* after variant formation, though in some instances the reversion form is not identical with the initial strain. It is possible that a cycle of variant formation and reversion might, for this reason, lead to better penicillin-producers. Autolysed cultures of *A. niger* produce variants that seem to be eliminated by culturing at optimum temperature and frequent transfers.

Sharp (L. W.). **Fundamentals of cytology.** x + 270 pp., 125 figs., 51 diags., New York & London, McGraw-Hill Book Company, Inc., 1943. $3.00.

This text-book, intended for use in connexion with college and university courses in the biological sciences, contains numerous references of interest to mycologists and plant pathologists, including sections on the cytology of reproduction in the fungi, the structural components of protoplasts (among them the intracellular bodies characteristic of certain plant viruses), chromosomal aberrations, and so forth. A list of works proposed for reading in conjunction with each chapter is appended.

Yarwood (C. E.) & Hazen (W. E.). **The relative humidity at leaf surfaces.** *Amer. J. Bot.*, xxxi, 3, pp. 129–135, 1 fig., 4 graphs, 1944.

On the basis of a study of the relative humidity at leaf surfaces [determined by a method which is described in detail], the authors formed the opinion that the humidity at leaf surfaces more nearly approaches that of the surrounding atmosphere than that of the intercellular spaces, contrary to the view commonly held that it more nearly approaches that of the latter than that of the former. The authors believe that data such as published by Karla Longrée [*R.A.M.*, xviii, p. 681], who reported that spores of *Sphaerotheca pannosa* var. *rosae* germinated better on leaf surfaces than on glass slides in the same environment, are more likely explained by host stimulation of the germination of powdery mildew conidia as observed by Yarwood in 1936 [ibid., xvi, p. 104] than on the basis of the supposed high humidity at leaf surface.

Magrou (J.), Douchez (Mlle Y.), & Segretain (G.). **Symbiose de la Pomme de terre avec les endophytes de diverses plantes.** [Symbiosis of the Potato with the endophytes of various plants.]—*Ann. Inst. Pasteur*, lxix, 7–8, pp. 246–247, 1943.

Experiments were conducted to determine the conditions under which symbiosis between the cultivated potato and the endotrophic mycorrhizal fungi of other plants could be effected, thereby simulating the ancestral environment of the potato [*R.A.M.*, xviii, p. 341]. There are two types of endotrophic mycorrhiza, one represented by *Arum maculatum* [ibid., xv, p. 243] and the other by *Paris quadrifolia*; in the former the main stems of the mycelium are intercellular and extrude into the cells branches which develop into arbuscules, whereas in the latter the entire fungus is strictly intracellular. Besides *A. maculatum*, the following plants of the same mycorrhizal type were chosen for the tests: *Bellis perennis*, *Orobus tuberosus*, and *Mercurialis perennis*, while *Ficaria ranunculoides*, *Viola horta*, and *Solanum dulcamara*, as well as *P. quadrifolia* itself, represented the intracellular form. The potatoes were raised from seed in the various mycorrhizal soils, either in pots for laboratory studies or *in situ* in the Paris and Poitiers regions.

In all cases the potatoes developed a profusion of mycorrhiza either of the *A. maculatum* or *P. quadrifolia* type, according to the particular plant with which they were in contact. Of special interest is the case of *B. perennis*, the characteristic fasciculate grouping of the straight intercellular hyphae of its endophyte being exactly reproduced in the potato mycorrhiza. It is also worthy of mention that the endophyte of a monocotyledonous plant, such as *A. maculatum*, can invade the dicotyledonous potato. The symbiotic potato plants produced 'primary' tubers, which on replanting the following season in the Paris district gave satisfactory yields of 'secondary' tubers for seed. For instance, 65 of the 'primary' tubers of plants sown in 1941 in a meadow containing large numbers of *B. perennis* were replanted in 1942 in manured ground and produced a total yield of 63,750 kg., or an average of 0·980 kg. per plant, corresponding to a harvest of 29·4 tons per ha., which compares favourably with the output of 15 to 18 tons per ha. normally regarded as adequate.

Magrou (J.), Bouget (J.), & Segretain (G.). **Semis symbiotiques de Pomme de terre dans les Pyrénées.** [Symbiotic sowings of Potato in the Pyrenees.]—*C.R. Acad. Sci., Paris*, ccxvi, 16, pp. 501–503, 1943.

In the spring of 1942, potato seed of different varieties was sown under glass at Bagnères-de-Bigorre (Pyrenees) in mountain soil harbouring numerous mycorrhizal plants [see preceding abstract]. The resultant very vigorous plants were transferred between May and July either to manured fields or to the uncultivated, recently cleared ground whence the soil for the experiments was taken. The yield was not remarkable, since many of the plants died from drought, but the size of the tubers (up to 9 by 4·5 cm.) does call for comment, being exceptional for the products of a symbiotic stand. The roots were yellow (a characteristic sign of mycorrhiza in the potato), and moreover, microscopic examination revealed an extensive infestation. The mycorrhiza probably functioned as purveyors of nitrogen, which occurs principally in a form unassimilable by plants in the soils in question.

Samuel (G.). **Potato haulm killing.**—*J. Minist. Agric.*, li, 6, pp. 277–279, 1944.

The practice of killing off potato haulms at the end of the season with sulphuric acid or other sprays is now [*R.A.M.*, xvi, p. 55; xvii, p. 131] carried out in England over thousands of acres. It is, however, unnecessary if the haulms begin to die off naturally before the end of September, or if blight [*Phytophthora infestans*] kills off

the haulms by lifting time. It is safe to let blight completely kill the tops if the tubers are well earthed up and the soil does not allow the spores to penetrate to the tubers. On dry soils and those that crack on drying, blight, if present on the tops for long, may infect many tubers in the soil. Under such conditions, the tops should be burnt off as soon as infection becomes prevalent in the crop. The best time to burn off depends partly on the weather; increased infection on the tops is not very dangerous when only light rains are experienced, but a heavy rain may carry the disease into the soil. Growers should have their own spraying machines, so that if a heavy rain threatens in autumn, blighted haulm can quickly be burnt off as a precaution.

Two useful substitutes for sulphuric acid are a mixture of copper sulphate and salt (30 lb. powdered bluestone and 10 lb. salt. per 100 gals. water) and tar distillate washes. The former is not satisfactory on vigorously growing haulm when it has to be killed off by seed growers and it does not destroy the stems as effectively as sulphuric acid, while the tar distillate washes take 10 to 14 days to kill the leaves and cost about three times as much as sulphuric acid. Sodium chlorate and calcium cyanamide were used before the war, but are no longer obtainable. Some firms now make apparatus for atomizing undiluted sulphuric acid, and the saving of water-carting which this permits is important in some areas. It is hoped that there may be further developments in this process, which may prove very valuable in haulm killing.

As haulm destruction checks growth at once, premature treatment may appreciably reduce yield; even in September, crops with green haulm can put on over ½ ton of tubers per acre per week. The method remains, however, a most valuable aid in safeguarding tubers from infection at lifting time, especially in a wet autumn.

Payette (A.) & Perrault (C.). **Action de la thiamine sur le Phytophthora infestans (Mont.) de Bary.** [The action of thiamin on *Phytophthora infestans* (Mont.) de Bary.]—*Canad. J. Res.*, Sect. C, xxii, 3, pp. 127–132, 1 pl., 1944. [English summary.]

Phytophthora infestans when grown in culture appeared to require thiamin, maximum effects resulting from 0·2 μgm. in 1 c.c. of the liquid mineral-dextrose medium containing asparagin and organic acids. Unlike *Phycomyces blakesleeanus*, *Phytophthora infestans* failed to respond to the pyrimidin and thiazole derivatives of thiamin. Inositol in combination with thiamin at certain concentrations appeared to inhibit the effect of the thiamin to some extent, whereas a yeast extract, almost ineffective by itself, appeared to increase it.

McIntosh (T. P.). **Potato troubles.** *Gdnrs' Chron.*, Ser. 3, cxvi, 3010, pp. 87–88, 1944.

Experimental evidence is briefly adduced from the Seed Testing and Registration Station, Corstorphine, Edinburgh, to show that potato virus X is transmissible by contact between the sprouts of diseased and healthy tubers in storage.

In a small-scale test to determine the effect of chilling on the incidence of dry rot [*Fusarium caeruleum*], 1 cwt. Catriona tubers was divided into three lots, of which one was kept continuously in a storehouse free from risk of cold, a second was removed from the same place during frosty weather in December for 3½ hours on several days, and a third was similarly treated for seven hours. All were left in the same storehouse until 25th April, when the incidence of dry rot in the three lots was found to amount to 13·5, 23·5, and 35·5 per cent., respectively. In a comparable test with Doon Star tubers, in which, however, the exposures were carried out at a somewhat higher temperature in March, the amounts of dry rot in the chilled and unchilled lots were 10 and 6 per cent., respectively. The reason for the greater susceptibility of the chilled lots is not clear, but the control had least

reducing sugars when tested in January. The growth of plants raised from unchilled tubers was much more rapid and vigorous than that from the chilled, and it would appear from these admittedly scanty data that chilling may be responsible for larger reductions in field and garden crops than is generally suspected.

HARVEY (R. B.), REICHENBERG (A.), LEHNER (BERNICE), & HAMM (P. C.). **Hair sprout of Potatoes.**—*Plant Physiol.*, xix, 2, pp. 186–193, 1944.

'Hair sprout', characterized by the precocious sprouting of potato tubers at 65° F. (the normal storage temperature), notably among the Bliss Triumph and White Rose varieties, is only of sporadic occurrence in Minnesota, but in 1938 it was sufficiently prominent to decrease the value of the affected crops for seed purposes. The hair sprouts are usually less than 2, often only 1 mm. in diameter, and grow rapidly, producing a succession of tubers, 1 to 2 cm. in diameter, either directly appressed to the mother tuber or borne on a stolon up to several cm. or on side branches some inches in length. They continue to grow under favourable conditions, reaching a length of 6 to 8 ft. in darkness, with branching rudimentary leaves, but not increasing appreciably in diameter. In short, hair sprouts resemble stolons rather than stems. Some of the early-sprouting buds produce shoots of a diameter intermediate between normal and hair sprouts, which may be differentiated from the former, however, by the premature formation of shoots. A single tuber may give rise to normal and hair sprouts (intermediate and extreme), the aberrant condition apparently being common to all the buds in one eye. Hair sprouts are positively phototropic, but collapse from stem weakness after a few inches of growth. The small tubers produced by hair-sprout plants in the greenhouse gave rise to normal plants, indicating that the condition is not hereditary. It was further experimentally shown not to be transmissible by grafting hair sprout scions on normal stock and vice versa, and that it cannot be transmitted from the tuber to normal buds or corrected in hair sprout buds by reciprocal grafting.

No substantial difference was detected by analytical methods between normal and hair-sprout Bliss Triumph tubers in respect of total nitrogen, pentosans, and pentoses on the dry-weight basis. There was, however, a consistently higher percentage of reducing and total sugars and a decrease in percentage dry weight of hair-sprout White Rose tubers as compared with normal ones of the same variety. For instance, the percentage dry weights (average) of normal, intermediate, and extreme hair-sprout tubers (seven in each group) were 22·73, 20·55, and 17·19, respectively, the corresponding figures for reducing and total sugars being 2·82, 5·44, and 8·65, and 4·11, 7·14, and 10·60, respectively. Differences of this order were maintained both at high and low storage temperatures. There was no consistent differential trend in the starch percentages of normal and hair-sprout tubers.

MICHENER (H. D.). **An experiment on the physiological nature of spindling sprout.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 511–513, 1943.

An experiment is described which showed that potato spindling sprout [*R.A.M.*, xx, p. 377] stems increase in size when grafted on to normal stems (on the average 0·9 and 0·8 mm. in main and lateral stems, respectively, compared with a decrease of 0·1 and 1·0 mm., respectively, for normal scions on normal stock). The most probable explanation of this is that the spindling sprout stems derive something from the normal stems which they otherwise lack. The spindling sprout tuber may, therefore, lack some substance necessary for normal growth, or it may contain all necessary substances but lack the means to move them to the growing stem.

WATSON (R. D.). **Charcoal rot of Irish Potatoes.**—*Phytopathology*, xxxiv, 4, pp. 433–435, 1 fig., 1944.

This is an expanded account of the writer's studies on charcoal rot of potatoes

(*Sclerotium bataticola*) [*Macrophomina phaseoli*] in eastern Texas, a preliminary note on which has already appeared [*R.A.M.*, xxiii, p. 187]. High temperature (80° to 85° F.) being the chief environmental factor conducing to the pathogenicity of the fungus, early planting and harvesting and cool storage (34° to 38°) are important control measures. The disease is also favoured by abundant humidity, and the crop should therefore be grown only on well-drained sites, while storage in crates will assist in the maintenance of a dry atmosphere and provide air circulation, thereby reducing the incidence of secondary rots.

Diehl (W. W.). **Bibliography and nomenclature of Puccinia oryzae.**—*Phytopathology*, xxxiv, 4, pp. 441–442, 1944.

Puccinia oryzae, apparently a distinct race of *P. graminis*, has hitherto been reported only from limited areas in Spain and Italy, but a recent paper by O[lga] Săvulescu (*Bull. Sect. sci. Acad. roum.*, xxii, 7, pp. 305 308, 1940) points to the existence of the rust also in Rumania. The economic importance of this rice parasite is normally inconsiderable, and little attention has therefore been accorded to it, but its destructive potentialities are such as to justify universal quarantine measures against it. Critical comments are made on the few references to the rust in the scientific literature, and the conclusion is reached that the name *P. oryzae*, for which Briosi omitted to furnish a technical description, is a *nomen nudum*, but as treated by González Fragoso (*Trab. Mus. Cien. nat., Madr.*, Ser. Bot., 15, 1918), it would be valid as *P. graminis* Pers. f. *oryzae* Frag.

Addicott (F. T.). **A note on the effect of splash injury in Guayule seedlings.**—*Phytopathology*, xxxiv, 5, pp. 508–510, 1 fig., 1944.

The overhead method of watering guayule [*Parthenium argentatum*] seedlings in nursery beds tends to produce a condition herein designated 'splash injury', which results in severe losses at the cotyledon stage. The outstanding external symptoms of the trouble are a brown discoloration and apical and marginal shrivelling of the cotyledons. The examination of fixed and stained preparations of affected material from a nursery at Salinas, California, revealed plasmolysis, cytolysis, and final complete collapse of nearly all the parenchyma cells in the cotyledon. There was no evidence of parasitic intervention in the causation of the disturbance, which is attributed to the beating of soil or water on the plant or their accumulation round it.

Langford (M. H.). **Fungicidal control of South American leaf blight of Hevea Rubbertrees.**—*Circ. U.S. Dep. Agric.* 686, 20 pp., 7 figs., 1 diag., 1943.

Under a co-operative arrangement between the United States Department of Agriculture and the Goodyear Rubber Plantations Company, the writer initiated spraying and dusting tests for the control of South American leaf blight (*Dothidella ulei*) of *Hevea* rubber seedlings at All Weather Estate, Panama, in 1940. Shortly after the conclusion of these experiments in July, 1941, further tests with some of the more promising materials were undertaken at the Department's Co-operative Rubber Field Station, Turrialba, Costa Rica, and at the Goodyear Company's Speedway Estate, Cairo, Costa Rica.

The results of the preliminary tests indicated that the disease could be economically combated by weekly spraying either with 'insoluble' copper (basic copper sulphate, copper silicate, copper phosphate, copper oxychloride, and cuprous oxide) or wettable sulphur, with the addition of a spreader, such as casein plus wheat flour. The feasibility of these methods of control was confirmed by the subsequent more extensive trials. Summarizing the data obtained in the initial tests in

Panama and those at Cairo, Costa Rica, it may be stated that some 70 per cent. of the treated seedlings reached budding size within a year, as against only 15 to 20 per cent. of the controls. At Turrialba, where conditions are particularly favourable to the development of *D. ulei*, spraying increased the number of buddable one-year-old seedlings from 0 to over 60 per cent.

The important factor in the success of spraying for the control of leaf blight is the location of the seedling nurseries at a distance of several hundred yards from the nearest rubber trees. At All Weather Estate a nursery of some 1,000 susceptible seedlings was planted beside a badly diseased one-year-old stand, and on the same day another was laid out 500 yards from the nearest infected trees, neither being sprayed. In the former, a high incidence of blight developed as soon as the seedlings emerged from the soil, whereas in the latter the disease did not appear until the plants were several weeks old.

Since the residues of copper sprays have been found to exert a detrimental effect on budwood, it is advisable to substitute wettable sulphur for copper in the later applications. E. T. Stanwood, who experienced this difficulty at the Co-operative Rubber Plant Field Station in Honduras, found that the residue could be largely removed by three seconds' immersion of the budwood in 0·3 per cent. hydrochloric acid, immediately followed by thorough rinsing in running water.

Tests which are still in progress have indicated the practicability of controlling leaf blight by spraying high-yielding, susceptible budded trees until they reach a size suitable for top-budding. Promising results were also obtained by the treatment of 40 five-year-old trees during the annual leaf-change period in March, 1941, when five applications of a copper fungicide at four- to six-day intervals permitted the retention of 90 per cent. of the leaves, whereas the unsprayed controls were repeatedly defoliated and consequently suffered from die-back.

Full directions are given for the location and layout of *Hevea* nurseries and for spraying procedures. The most economical type of equipment depends on the size of the nursery, an inexpensive knapsack sprayer sufficing for 1,000 to 2,000 plants, a barrel pump for rather larger estates, while a power-machine of at least 300 lb. pressure, with a triple-nozzle gun with No. 3 disks, is the most effective apparatus for large-scale use. In general, the 'insoluble' coppers and wettable sulphurs should be applied at dosages of 2 and 6 lb., respectively, per 100 gals.; in the writer's tests, 150 to 250 lb. copper or 600 to 1,000 lb. sulphur has been requisite to bring each acre of susceptible seedlings to budding size. Fermate (1½ lb. per 100 gals.) gave equally efficient control with the copper fungicides in preliminary tests. The casein plus flour spreader should be used at the rate of ¼ : 2 : 100, or the former alone at ½ : 100. From limited experiments at Turrialba the total cost of protecting field-spaced, high-yielding, susceptible trees until they are ready for top-budding is computed at under $5 an acre.

Balks (R.) & Wehrmann (O.). **Schädigungen der Kulturpflanzen durch Grubengas?** [Damage to cultivated plants from mine gas?]—*Forschungsdienst*, xvii, 3, pp. 133–138, 1944.

The presence of methane in the soils of German mining districts was shown by analytical studies to be responsible for a pathological condition expressed by the poor state of health of the crops grown therein. In some of the samples investigated the methane content of the soil atmosphere was over 90 per cent. Abnormal features of such soils include a musty odour, deterioration in the crumb structure, and a dark grey to blackish-blue discoloration, especially of the predominant brown to reddish arable soils. The gas deprives the soil atmosphere of the oxygen essential both for plant life and the beneficial soil microflora, thereby adversely affecting the oxidation-reduction processes.

HEWITT (E. J.). **Experiments in mineral nutrition. I. The visual symptoms of mineral deficiencies in vegetables and cereals grown in sand cultures. Progress Report No. 1, 1943.**—*Rep. agric. hort. Res. Sta. Bristol, 1943*, pp. 33–47, [1944].

In continuation of the work of T. Wallace on the diagnosis of mineral deficiencies in plants by visual symptoms [*R.A.M.*, xxii, p. 406], cereals and vegetables were grown in sand culture for the systematic study of mineral deficiency symptoms produced under conditions of controlled nutrient supply. The aims of the investigation included the determination of the effects of added sodium sulphate and sodium chloride with special reference to the use of salt as a fertilizer, the study of the problems involved in maintaining large-scale deficiency culture experiments using a wide range of crops, and the development of a technique for the study of trace element deficiencies, using rain water, and distilled water. A tabulated, systematic description is given of typical deficiency symptoms observed on maize, cabbage, cauliflower, marrowstem kale, turnip, lettuce, radish, celery, sugar beet, broad and dwarf beans, red clover, flax, leek, tomato, and potato, the number of days after which they became evident being shown in each case.

It is concluded that the use of unwashed sand is suitable for major-element deficiency cultures and boron and manganese deficiencies in some crops, but not for iron deficiency. Pre-treatment with complete nutrient before sowing is suitable for nitrogen, phosphorus, potash, and magnesium deficiencies in most plants, but not for calcium deficiency, or for potassium and magnesium deficiencies in cereals.

CHOWDHURY (S.). **Diseases of Pan (Piper betle) in Sylhet, Assam. Part I. The problem and its economic importance. Part II. Phytophthora foot-rot and leaf-rot. Part III. Effect of manuring on the incidence of Phytophthora foot-rot and leaf-rot diseases.**—*Proc. Indian Acad. Sci.*, Sect. B, xix, 5, pp. 147–170, 1 pl., 1 graph, 1 map, 1944.

Pan (*Piper betle*) diseases were first reported in 1929 from the Sylhet district of Assam, where they constitute a serious economic problem. A survey instituted in 1939 under Government auspices to study the extent, etiology, and possibilities of control of the troubles, has yielded the following information. Since 1929–30, the area under *P. betle* in the affected region has decreased from 1,513·8 to 679·8 acres in consequence of the diseases; the number of families engaged in the cultivation of the crop (the hereditary occupation of a special class) has sunk from 4,709 to 3,348; the life of a 'boroj' (a specially constructed house, with sides of grass or straw on a bamboo framework, in which the pan vines are grown) has been shortened on account of pan diseases from 15 to 30 or even up to over 50 years to three or five; while the annual financial loss from the death of the plants is computed at Rs.849,748. The most important diseases are foot and leaf rot (*Phytophthora parasitica*) [*R.A.M.*, vi, p. 579], *Rhizoctonia* root rot, and a sclerotial wilt, of which the first-named is the most widespread and destructive; a foliar disorder due to *Gloeosporium* sp. is prevalent but causes little damage.

The optimum temperature for the development of *P. parasitica* was found to be 28° C. [ibid., xix, p. 258]: five minutes' exposure at 48° kills the pathogen. In the form of dormant mycelium inside planting setts the fungus may be transferred from one place to another, while local spread can be effected by means of drainage water and contaminated soil. The foot and leaf rot are controllable by monthly applications of 2:2:50 Bordeaux mixture at the rate of 1 gal. per ridge 5 ft. in length during the rainy season from May to September. Experiments were carried out to determine the relative efficacy in the prevention of infection of three soil treatments, viz., burning with rice straw, thatching grass, or similar material so as to raise the temperature to between 60° and 70° (the thermal death point of

P. parasitica is 48°); disinfection with 2:2:50 Bordeaux mixture at a dosage of 25 gals. per 100 sq. ft. and kerol (1 in 600, 20 gals. per 100 sq. ft.). The mortality in the three groups of 480 plants receiving these treatments was 5, 8, and 10, respectively, corresponding to percentages of 1·02, 1·66, and 2·08, respectively, while 290 (62·83 per cent.) of the same number of controls were killed by the fungus. After soil sterilization only healthy setts should be planted, and precautions against reinfection through contaminated soil or drainage water are essential.

Different manurial treatments did not materially influence the incidence of foot and leaf rot, which was approximately equal (27 to 28 per cent.) in plots supplied with oil cake, sodium nitrate, or ammonium sulphate, or mixtures of sodium nitrate or ammonium sulphate with superphosphate and potassium sulphate. The average leaf yield, however, was slightly higher in the oil cake-treated plots.

Nirula (R. L.). **Histopathology of Betel Vine leaves attacked by a bacterium.**—*Sci. & Cult.*, x, 1, p. 58, 1944.

Since 1931, when a note on the subject was published in *Proc. Indian Sci. Congr.*, the writer has been engaged on a histopathological study at the College of Science, Nagpur, on a bacterial invasion of cut, stored betel vine [*Piper betle*] leaves. Ingress is usually gained through the cut end of the petiole, though any point on the lamina may occasionally serve as a channel of entry. A water-soaked area develops round the site of attack, to be followed by a brown discoloration and later by blackening along the veins. The phloem tissues become involved at an early stage and are rapidly destroyed, sometimes in the course of a few hours, for a considerable distance along the petiole, midrib, and veins, these effects being apparent to the naked eye in the softening and pulpiness of the dorsal surface of the midrib and some of the veins. The bacterium next reaches the xylem vessels and mesophyll cells, the phloem elements meanwhile having died and undergone disorganization. The same processes occur in the mesophyll cells, whence the pathogen migrates into the intercellular spaces.

Rafay (S. A.), Padmanabhan (S. Y.), & Khanna (K. L.). **Control of Sugarcane seedling disease and nematode injury.**—Abs. in *Proc. Indian Sci. Congr.*, xxix, Sect. xi, p. 218, 1942. [Received May, 1944.]

The examination of the rootlet, collar, and leaf sheath regions of withering and dying sugar-cane seedlings at the Bihar Research Station in April, 1940 and 1941 revealed infection by a species of *Pythium*, which was isolated in pure culture and used in inoculation tests with positive results. Associated with the fungal disease was a foliar discoloration due to nematode injury, this being the first record of the latter organism on sugar-cane seedlings in India. Satisfactory combined control of the fungus and nematode was obtained by one hour's sterilization of the seed-bed soil at 95° C., while the former pathogen was effectively combated by bi-weekly applications to the soil of copper sulphate solution (1 in 10,000) or Cheshunt compound.

Murrill (W. A.). **Florida Boletes (Boletaceae).**—*Contr. Herb. Univ. Fla*, 6 pp., 1942. [Mimeographed. Received August, 1944.]

The system adopted in this annotated list of Florida Boletaceae [cf. *R.A.M.*, xxiii, p. 410] is based on that proposed by Snell (*Mycologia*, [xxiii, pp. 415–423, 1 fig.], 1941), with the exception of certain alterations necessitated by the International Code. Twelve genera are represented, including a new one, *Frostiella*, a key for assistance in their recognition being provided.

Valleau (W. D.), Johnson (E. M.), & Diachun (S.). **Angular leafspot and wildfire of Tobacco.**—*Bull. Ky agric. Exp. Sta.* 454. 60 pp., 13 figs., 1943.

Studies on tobacco wildfire (*Bacterium* [*Pseudomonas*] *tabacum*) and angular leaf spot (*Bact. angulatum*) [*P. angulata*: *R.A.M.*, xxiii, p. 281] showed that colonies from a pure culture are uniform in type on agar plates, but those produced by different strains differ widely. The colonies range from watery to firm and show various degrees of roughness. Rough cultures have characteristic folded patterns for each colony. Rough and smooth colonies are equally pathogenic. Colony types are somewhat constant in successive transfers and passages through leaves and in storage. Individual leaf spots yield several colony types which, when separated, are fairly constant. The pathogenicity of strains of both organisms ranges from weak to typical spot-producing. *P. tabacum* appears to be a chlorolytic strain of *P. angulata*. No evidence was found that the organisms are identical with *P. fluorescens* [ibid., xxii, p. 80].

Seed is seldom infected with either organism, and seed-borne infection appears to have no part in outbreaks. Evidence was obtained that seed for immediate sowing may be pre-soaked for one hour and then submitted to hot-water treatment at 52° C. for 20 minutes without injury to germination. In dried tissue, the bacteria were generally killed by exposure to 52° for six minutes. The causal organisms appear to be common soil inhabitants living on the surface of the rootlets of various weeds and crop plants [loc. cit.].

Both diseases can be prevented in the plant bed by one or two applications of Bordeaux mixture to the surface of the soil when the plants are small. Plants unaffected at transplanting may contract both diseases after being set out in the field. Both organisms were occasionally isolated from the roots of tobacco plants from Bordeaux-treated beds. Infection can also originate in the field. Injuries by flea-beetles (*Epitrix parvula*) on ground leaves were found to be infected with *P. angulata* in early July. Leaf infection usually takes place through the stomata, but only when the tissues have become so water-soaked that a water channel is formed from the outside of the leaf to the inside, or when bacteria are carried in with water dashed or sprayed against the leaf surface. [Cf. ibid., xxii, p. 114.] Infection may also occur through wounds.

All rapidly-developing tobacco leaves are susceptible to both organisms, but as the leaves mature they become highly resistant. Once the highly susceptible stage is passed, infection takes place less readily through the upper surface than through the lower. In the plant bed the plants are most susceptible when the leaves are 2 to 4 in. long. In field conditions, infection is followed by greater injury to the leaf if the plant is growing in soil deficient in potash.

The condition known as 'blackfire' [ibid., viii, p. 680] and characterized by large, zonate spots on maturing tobacco leaves often appears to be a continuation of an outbreak of wildfire or angular leaf spot or both. It occurs at a time when the leaves do not usually respond to infection by *P. tabacum* and *P. angulata*. It is definitely related to soil fertility. In soil experiment fields it develops later and to a smaller extent on plots deficient in phosphorus (and well supplied with potassium and nitrogen) than on plots to which phosphorus has been added. No treatment on the soil experiment fields has given complete control, but plots to which nitrogen, phosphorus, and potassium were added developed less of the disease than plots not given a complete treatment, while manured plots and those to which ground tobacco stalks had been liberally added developed still less. Some growers have found that heavy applications of a medium-grade mixed fertilizer (sometimes as much as 1,500 lb. per acre) have entirely prevented the development of leaf spot late in the season. Most of the tobacco in areas where blackfire is severe shows signs of potassium starvation. There also seems to be a moisture relation, greatest damage occurring in long periods of damp weather.

Clayton (E. E.), Gaines (J. G.), Smith (T. E.), Shaw (K. J.), & Graham (T. W.). **Control of flue-cured Tobacco root diseases by crop rotation.**—*Fmrs' Bull. U.S. Dep. Agric.* 1952, 12 pp., 9 figs., 1944.

The following diseases constitute a grave problem for growers of flue-cured tobacco in the south-eastern United States: black shank (*Phytophthora parasitica* var. *nicotianae*), bacterial wilt (*Bacterium* [*Xanthomonas*] *solanacearum*), *Fusarium* wilt (*F. oxysporum* var. *nicotianae*), southern stem rot (*Sclerotium rolfsii*), and sore shin (*Rhizoctonia* [*Corticium*] *solani*). Their symptoms are briefly described, a key being furnished to assist in diagnosis, and directions given for their control by crop rotation, based on co-operative experiments in Georgia and North and South Carolina. The relevant information concerning black shank and bacterial wilt has recently been presented [*R.A.M.*, xxiii, pp. 412, 413].

Among the best crops for growing in rotation with tobacco from the standpoint of root disease control are *Crotalaria*, oats, rye, or wheat, and redtop [*Agrostis vulgaris*]; maize, cotton, cowpeas, *Lespedeza*, soy-beans, and velvet beans [*Mucuna deeringiana*], though safe in respect of disease, should be avoided wherever root knot (*Heterodera marioni*) infestation is suspected; potato, tomato, and chilli involve such disease hazards to the succeeding tobacco crop that they should be entirely excluded from the rotation; while sweet potatoes, though resistant to black shank and bacterial wilt, are susceptible to *F. oxysporum* var. *nicotianae* and should never be planted on land to be used for tobacco. The cultivation of tobacco in rotation with stem rot-susceptible crops, e.g., groundnut and soy-beans, has not resulted in any increase in disease. Some of the best alternative crops for disease control, e.g., *Crotalaria* and runner groundnuts result in tobacco of inferior quality, but only when these crops immediately precede tobacco; such unfavourable effects can be eliminated by interposing another crop, e.g., oats.

Melchers (G.). **Über einige Mutationen des Tabakmosaikvirus und eine 'Parallel-mutation' des Tomatenmosaikvirus.** [On some mutations of the Tobacco mosaic virus and a 'parallel mutation' of the Tomato mosaic virus.]—*Naturwissenschaften*, xxx, 1–3, p. 48, 1 fig., 1942.

A mutant of the tobacco mosaic virus arising spontaneously in the author's experimental material is named *Marmor tabaci* var. *flavum*. It induces on Samsun tobacco leaves primary yellow lesions, followed by secondary developments in the shape of conspicuous vein-clearing, much more pronounced stunting of the whole plant than that caused by ordinary tobacco mosaic, and a yellowish-green mottling of the more or less deformed foliage.

M. t. var. *tenue* was isolated from the juice of plants inoculated with tobacco mosaic and grown at 34° C. On Samsun tobacco there were no primary symptoms, and the secondary spotting was limited to dark green areas along the veins and pale green ones in the interveinal spaces. A strain isolated from a pale lesion on a plant infected by *M. t.* var. *tenue* was named *M. t.* var. *necroticum*. Besides the typical symptoms of *M. t.* var. *tenue*, it induced the formation on the leaves following that primarily infected of small, pale, necrotic spots.

The tomato mosaic virus previously described as 'tomato mosaic virus Dahlem 1940' [*R.A.M.*, xx, p. 236] produces on Samsun tobacco even milder symptoms than those of *M. t.* var. *tenue*. It differs from ordinary tobacco mosaic and the other mutants described in this paper in its capacity to induce on Java tobacco and *Nicotiana sylvestris* primary necrotic symptoms, which do not appear on beans. It is named *M. t.* subsp. *dahlemense*. A mutant arising spontaneously from this virus and named *M. t.* var. *luridum* is characterized by the production on tobacco of primary yellow and secondary yellow-green spots, accompanied by dwarfing of the same order as that caused by *M. t.* var. *flavum*.

Tartakowsky (S.), & Armando Garcia (A.). **Ensayos preliminares sobre control del damping-off del Tabaco.** [Preliminary experiments on the control of Tobacco damping-off.]—*Bol. Sanid. veg. Chile*, ii, 1, pp. 20–24, 1942.

The most promising results in preliminary tests on the control of tobacco damping-off (*Pythium debaryanum*, *Botryobasidium* [*Corticium*] *solani*, *Peronospora hyoscyami* de Bary (= *P. nicotianae* Will. & Speg.) [*P. tabacina*], *Botrytis cinerea*, etc.), at Santiago, Chile, were obtained by seed treatment with uspulun dust at a dosage of 300 gm. per kg. or with a mixture of the same and mersysol (300 gm.) and by soil disinfection with zinc oxide (300 gm. per sq. m.). By these methods the incidence of infection was reduced from 31 to 19 per cent. Next in order of efficacy (22 per cent. infection) came seed treatment with copper carbonate (300 gm. per kg.) and soil disinfection with 1 per cent. basicop (5 l. per sq. m.).

Jones (J. O.), Nicholas (D. J. D.), & Wallace (T.). **Experiments on the control of magnesium deficiency in greenhouse Tomatoes. Progress report I.**—*Rep. agric. hort. Res. Sta. Bristol, 1943*, pp. 48–53, [1944].

In experiments on the control of magnesium deficiency in greenhouse tomatoes carried out in 1943, marked control followed an application to the soil of magnesium sulphate at rates from 4 to 8 cwt. per acre before planting, with top dressings at 2 cwt. per acre, in the presence and absence of potash in the basal dressings. Treatments at the rate of 4 cwt. per acre in 1942 were unsuccessful. Where potash was used the symptoms were more severe than where it was not employed. Some evidence was obtained that steam sterilization gives partial control. The results suggest that a considerable degree of control can be obtained by the addition of 4 to 8 cwt. per acre magnesium sulphate (calcined kieserite 30 per cent. MgO) to the basal fertilizer dressing.

Smith (P. G.). **Reaction of Lycopersicon spp. to spotted wilt.**—*Phytopathology*, xxxiv, 5, pp. 504–505, 1944.

The following observations on the reactions of tomato and other *Lycopersicon* spp. to spotted wilt under natural conditions at Salinas, California, are supplementary to D. R. Porter's (unpublished) discovery of a resistant strain of *L. pimpinellifolium* and to Wenholz's report on the resistance of the same species and an unnamed Peruvian type [*R.A.M.*, xix, p. 168]. In 1942, all 104 plants of various strains of tomato and hybrids with Porter's *L. pimpinellifolium*, and all 19 of a single strain of *L. hirsutum* (P.I. 134,417) were diseased, whereas none of the 21 of Porter's *L. pimpinellifolium* or the 48 of five strains of *L. peruvianum* (P.I. 126,930, 126,944, 126,946, 128,659, and 129,146) showed any signs of infection. In 1943, 39 out of 41 plants from known susceptible lots of tomato and hybrids contracted spotted wilt. Of two selections of the German Sugar tomato variety from Hawaii, one was highly resistant (3 out of 10 plants diseased) and the other susceptible. Ten plants each of two lots of Porter's *L. pimpinellifolium* and the *Fusarium*-immune Accession 160 of Bohn and Tucker [ibid., xix, p. 501] were planted, the former remaining immune and six of the latter becoming diseased. Of four lots of 10 plants each of *L. peruvianum* (P.I. 126,928, 126,944, 128,657, and 128,660), one plant of the last-named was probably diseased. The F_1 hybrid of tomato × *L. pimpinellifolium* Accession 160 and five back-crosses of tomato to this hybrid were susceptible, all 69 plants of these hybrids being wilted.

The data obtained in these trials confirm previous observations in regard to the resistance of *L. pimpinellifolium*, while that of *L. peruvianum* was also established. The utilization of the latter is complicated by its reluctance to cross with the cultivated tomato, but this drawback may be overcome by means of a special technique, particulars of which it is intended to publish elsewhere. The susceptibility

of one of the two strains of *L. pimpinellifolium* shows that this species is not uniformly resistant.

VAUGHAN (E. K.). **Bacterial wilt of Tomato caused by Phytomonas solanacearum.**—*Phytopathology*, xxxiv, 4, pp. 443–458, 1 diag., 6 graphs, 1944.

Tomato plants with incipient bacterial wilt (*Phytomonas* [*Xanthomonas*] *solanacearum*) often show no external symptoms of infection until a soil temperature of about 70° F. is reached, though the pathogen may actually become established at 55°. From 70° to 110° the rate of development of the disease increases with the rising temperature. Another essential for the growth of *X. solanacearum* is a constant, but not necessarily plentiful, supply of moisture. The organism is able to overwinter in soils at least as far north as central New Jersey. It does not appear to spread readily through infested soils except when these are moved by cultivating tools or flood water. In potato dextrose agar cultures the optimum hydrogen-ion concentration was P_H 6 to 8, very scanty growth being made below 5 and none at 4.

CROXALL (H. E.). **The control of blight (Phytophthora infestans) on outdoor Tomatoes.**—*Rep. agric. hort. Res. Sta. Bristol, 1943*, pp. 95–99, [1944].

In 1943, plots of six varieties of outdoor tomatoes at Long Ashton were sprayed on 29th July and 2nd September with Bordeaux mixture, proprietary mixtures containing cuprous oxide or copper oxychloride, and a spray containing copper sebacate, all the sprays being made up to contain the same amount of copper as Bordeaux mixture (4–4–100). Approximately 500 gals. per acre were applied on each occasion. The copper sebacate treatment was given only on the earlier date.

Phytophthora infestans appeared in the control plots in the last week of August, and by 1st October, when the final picking was made, all the fruit remaining on the unsprayed plots had become infected. Most of the fruit on the plots sprayed once with copper sebacate was infected, but the other treatments showed only about 2 per cent. infection. The yields of marketable fruits from the sprayed plots expressed as a percentage of those from the unsprayed controls were: Bordeaux mixture 244, copper oxychloride 232, cuprous oxide 227, copper sebacate 147. There were some differences in the effects of the treatments on the yields of different varieties, but Bordeaux mixture, copper oxychloride, and cuprous oxide produced a significant increase in yield with every variety. On all varieties taken together, the average increase in yield obtained by spraying twice with Bordeaux mixture, copper oxychloride, or cuprous oxide amounted to 5½ tons per acre, representing, at 6*d.* per lb., an increase of £310 per acre.

JENKINS (ANNA E.). **A recent account of anthracnose of Poplar in Italy.**—*Rev. argent. Agron.*, xi, 2, pp. 103–105, 1 pl., 1944.

In connexion with recent studies on poplar anthracnose (*Sphaceloma populi*) in South America [*R.A.M.*, xix, p. 366], attention is drawn to Servazzi's record in 1934 of leaf-withering ('seccume delle foglie') [ibid., xiii, p. 605] in Italy, where the pathogen was designated by Saccardo's name of *Hadrotrichum populi* [ibid., xii, p. 661].

PAINTER (J. H.) & DROSDOFF (M.). **Results of preliminary tests on correction of potassium deficiency in Tung.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 65–68, 1943.

In July, 1941, tung oil trees [*Aleurites fordii*] in southern Georgia and adjoining parts of Florida developed a serious disorder associated with a low potassium content in the leaf tissue. The deficiency pattern was of two types; in one, the affected part of the leaf was chlorotic, while in the other, areas in a similar pattern were necrotic. It was assumed that these patterns represented, respectively, early

and advanced stages of one disorder. By August, 1942, recovery had followed a heavy application of muriate of potash or an application of nitrate of potash of 14–0–44 composition given in addition to the basic application of 4 lb. per tree of 3–6–7 mixed fertilizer.

Dickey (R. D.) & Drosdoff (M.). **Control of manganese deficiency in a commercial Tung orchard.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 74–78, 1943.

Frenching of tung oil trees (*Aleurites fordii*), reported from Florida in 1937 [*R.A.M.*, xvii, p. 781], has reappeared in the same orchards and developed in other plantings. The prevalence of symptoms varies widely between orchards and between different areas in the same orchard. The symptoms are most pronounced early in the season, and may clear up without treatment as the season progresses.

In August, 1941, affected trees were given 1, 2, or 4 lb. 65 per cent. manganese sulphate per tree together with ½ lb. zinc sulphate. The manganese treatments were repeated in March, 1942, and, in addition, all the trees received 5 lb. of a 5–7–5 fertilizer and ½ lb. zinc sulphate. Frenching was materially reduced, reduction being directly proportional to the amount of manganese applied. The addition of magnesium sulphate failed to increase the effectiveness of the manganese sulphate, but ammonium sulphate (3 lb. per tree), either alone or in combination with manganese sulphate, was beneficial.

It is concluded that, in commercial orchard practice, severe manganese deficiency in mature tung trees in the locality in question can be satisfactorily corrected by a soil application of 2 lb. 65 per cent. manganese sulphate per tree.

Drosdoff (M.) & Dickey (R. D.). **Copper deficiency of Tung trees.**—*Proc. Amer. Soc. hort. Sci.*, xlii, pp. 79–84, 2 figs., 1943.

In 1941, an abnormal foliage condition, found to be due to copper deficiency, was noted in a few tung [*Aleurites fordii*] trees in a mature orchard near Morriston, Florida. In 1942, it was observed in several tung orchards in the Gainsville area; a newly planted orchard near Alachua, Florida, and a bearing orchard near Morriston, were also severely affected.

The most characteristic symptom was a 'cupping' of the terminal leaves, which, as a rule, were small and presented an interveinal chlorosis. The cupping and chlorosis were generally accompanied by a tip and marginal burn of the terminal leaves. As severity increased, the necrotic areas rapidly enlarged until the terminal leaves abscissed. The growing point eventually died and some of the affected shoots died back in varying degrees. Shoot growth from axillary buds was stimulated. At this stage, the older leaves showed interveinal chlorosis and ragged, necrotic margins. The symptoms may develop any time during the growing season; in 1941 they were first observed in late summer, whereas in 1942 they were widespread in spring.

Experimental evidence demonstrated that about 5 gm. copper sulphate in 350 ml. water, applied to the soil at the base of an affected one-year-old tree, was sufficient to effect recovery and maintain normal growth from midsummer to the end of the growing season. Complete recovery also followed spraying with copper sulphate solution (1 or 2 per cent.). In commercial practice, where young tung trees show copper deficiency and quick recovery is desired, 1 pint of a solution containing 1 lb. copper sulphate dissolved in 10 gals. water, applied to the soil at the base of the tree, should give satisfactory results. In areas where copper deficiency is prevalent, dry copper sulphate should be applied to the soil in spring, in addition to the zinc sulphate used locally. It is thought that 1 or 2 oz. would probably suffice for trees up to two years old. In mature orchards in copper-deficient soils about ¼ to ½ lb. copper sulphate per tree should be applied.

Birkinshaw (J. H.), Bracken (A.), & Findlay (W. P. K.). **Biochemistry of the wood-rotting fungi. 4. Metabolic products of Trametes suaveolens (Linn.) Fr.**—*Bio-chem. J.*, xxxviii, 2, pp. 131–132, 1944.

The volatile metabolic products of *Trametes suaveolens*, isolated on 5 per cent. aqeous malt agar from a sporophore on a willow [*Salix*] near Oxford, were identified as methyl anisate (the major constituent) and a small amount of anisaldehyde [*R.A.M.*, xix, p. 54]. These two substances are probably the chief contributors to the aroma of the fungus in culture. A little free anisic acid, possibly arising from atmospheric oxidation of the anisaldehyde, was also detected.

Rennerfelt (E.). **Die Entwicklung von Fomes annosus Fr. bei Zusatz von Aneurin und verschiedenen Extrakten.** [The development of *Fomes annosus* Fr. with the addition of aneurin and various extracts.]—*Svensk bot. Tidskr.*, xxxviii, 2, pp. 153–162, 1 graph, 1944.

The development of *Fomes annosus*, a destructive pathogen of Swedish spruce forests, was studied in a synthetic nutrient medium with the addition of various accessory growth substances [*R.A.M.*, xviii, p. 335], of which aneurin, at the rate of 0·1γ per flask of 200 ml. capacity, gave the best results, the dry weight of mycelium after 33 days being 57·6$\pm$4·5 mg. compared with 2·3$\pm$0·5, 38·2$\pm$3·2, 1·9$\pm$0·2, and 47·5$\pm$3·6 mg. in the cultures containing no extra vitamins, 0·05γ pyrimidin, 0·05γ thiazol, and 0·05γ pyrimidin +0·05 thiazol, respectively. A highly stimulatory effect was also exerted by yeast extract (0·5 or 1 ml. per flask), yielding dry weights of 55·6$\pm$3·9 and 55·3$\pm$2·8 mg., respectively, in five weeks, compared with 2·8$\pm$1 mg. in the controls. The growth of the fungus was also promoted to a moderate extent by extracts of humus and compost.

Stillinger (C. R.). **Notes on Cronartium occidentale.**—*Northw. Sci., Wash.*, xviii, 1, pp. 11–16, 1944.

Cronartium occidentale was observed for the first time in nature during the summers of 1919 to 1921 on *Ribes lasianthum*, *R. hesperium*, *R. parishi*, *R. roezli*, *R. speciosum*, *R. cereum*, *R. indecorum*, *R. malvaceum*, *R. nevadense*, and *R. montigenum* in Wyoming. The collections on *R. inerme* in California, *R. aureum* in Montana and Nevada, and *R. odoratum* in Idaho are the first in these States on the host in question, while the presence of the rust in Montana and Nebraska has not previously been reported. The apparent spread of *C. occidentale* from piñon pines (*Pinus edulis* and *P. monophylla*) to *Ribes* for a distance of 650 miles from known foci of infection and 425 miles beyond the ascertained range of the hosts is recorded, these observations having been made at Spokane, Washington, in 1912 and 1914. The rust was shown to be capable of overwintering on living *R.* leaves at Monrovia and Los Angeles, California (1920) and Denver, Colorado (1922). In view of the similarity between *C. occidentale* and *C. ribicola* [*R.A.M.*, xx, p. 187], the agent of white pine blister rust, it is thought not unlikely that the latter may also be conveyed over much longer distances than have hitherto been established for this species.

Buchholtz (W. F.) & Meredith (C. H.). **Pathogenesis of Aphanomyces cochlioides on taproots of the Sugar Beet.**—*Phytopathology*, xxxiv, 5, pp. 485–489, 2 figs., 1944.

This is an expanded account of the writer's observations in Iowa on the sugar beet root rot caused by *Aphanomyces cochlioides*, the salient features of which have already been presented in a summary [*R.A.M.*, xvii, p. 428].